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June 2010

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Radio Takes a Holiday

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In this issue:

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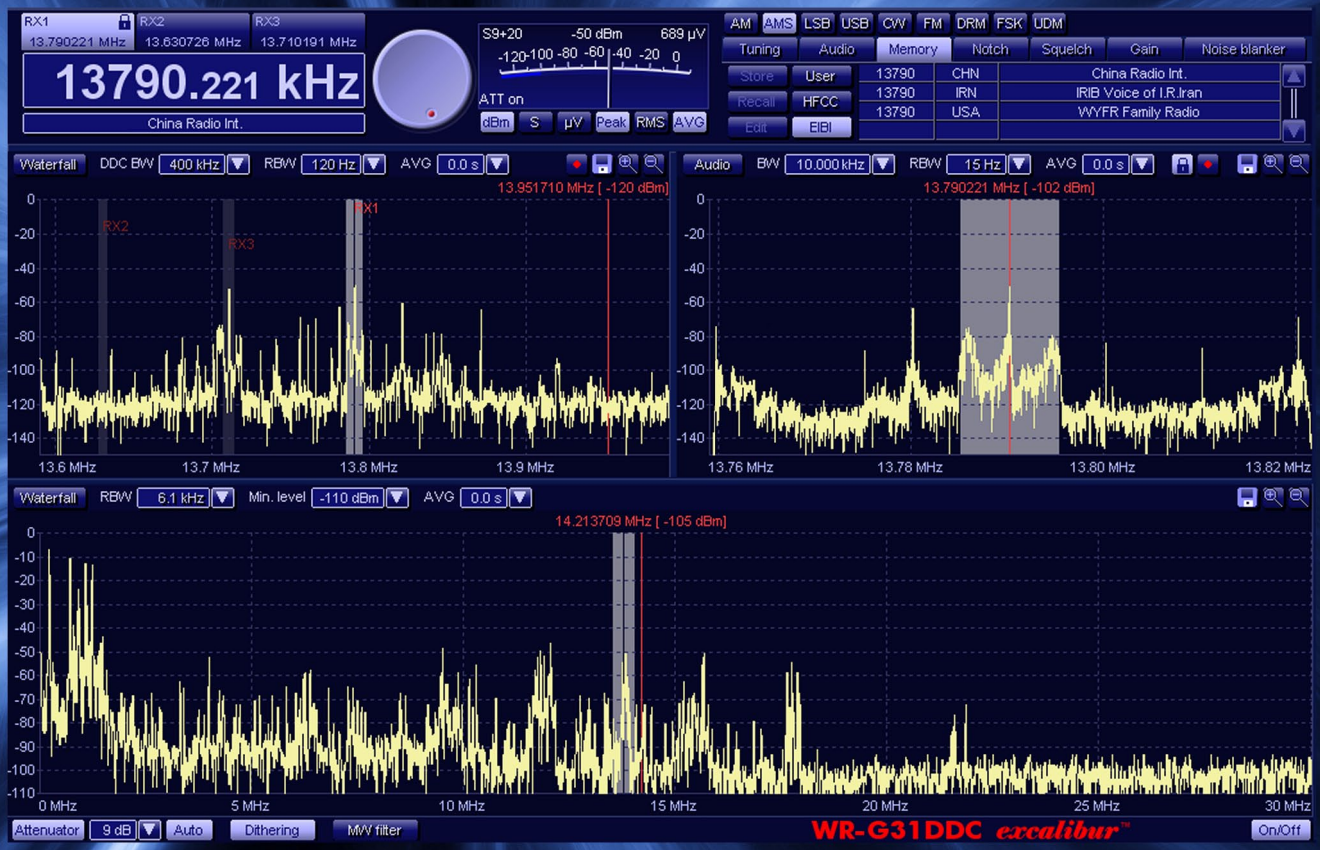

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Monitoring Times

Vol. 29 No. 6 June 2010

Cover Story 8
Radio Takes a Holiday

This summer, consider taking your radio hobby with you as you travel and truly broaden your horizons. If you're still making plans for your annual vacation, why not take in a radio museum along the way? You can go to any one or all of the radio museums listed in this issue.

Or, if you're a heartier soul, think about hiking, biking or boating into the wilds and work a little QRP DX or 2 meters while you're at it. Scanner enthusiasts can check out cities they've never heard before, aviation listeners can catch the action along unfamiliar air routes. There's plenty to hear while you're away! And, if you do, send us a postcard, or at least an e-mail with a photo and tell us what you've done.

On Our Cover

The seemingly endless waves of mountains in the Appalachian range provide the backdrop for a 2,100 mile hike along the Appalachian Trail where there are a surprising number of hams working HF QRP and 2 meters. (Courtesy: U.S. National Park Service). [Inset] Jim Cluett W1PID takes time to work a little HF QRP CW from a quiet, scenic spot along the trail. (Courtesy: Jim Cluett W1PID)

C O N T E N T S

R E V I E W S

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COMMUNICATIONS

by Ken Reitz

AMATEUR RADIO/SHORTWAVE

Icom: So Long IC-706MKIIG

Amateur radio manufacturer Icom America released a statement in late March that the company had depleted the existing inventory of its popular 706MKIIG model, consigning it to the realm of the many dozens of other popular transceiver models no longer made. The company called it one of the most popular series of transceivers in amateur radio history. The original model, IC-706 was brought out in 1995 and offered "base station performance in a mobile size transceiver, complete with detachable front panel."

Icom 706MKIIG (Courtesy: Icom)

Big Sale on Vanity Call Signs

According to a bulletin from the ARRL, the FCC plans to reduce the fee charged for amateur radio vanity call signs. In a Notice of Proposed Rulemaking and Order (NPRM) the FCC wants to reduce the fee from $13.40 for the 10 year license to (get ready!) $13.30.

Yes, in typical FCC procedural fashion, uncounted worker-hours will be spent over the next several months anguishing over the move to drop ten cents from the fee charged hams to hold a vanity call. Interestingly, in further typical FCC fumbling, many vanity calls will not be affected, as reported in the ARRL bulletin: "Those holding vanity call signs issued prior to 1996 are exempt from having to pay the …fee at renewal…because Congress did not authorize the FCC to collect regulatory fees until 1993. Such 'heritage' vanity call sign holders do not appear as vanity licensees in the FCC amateur radio database."

Hi-Tech Blimps to U.S. Military

This spring, tests of a 233 foot long unmanned dirigible being conducted over the vast military reservations of the southwestern U.S., could lead to their use as high-flying, semi-permanent, tethered surveillance platforms in rugged terrain such as Afghanistan, according to a report from Associated Press. Equipped with radar and radio frequency communications systems, the air ships could counter actions by ballistic missiles. According to the report, such ships could remain aloft for a month or more.

Raytheon dirigible in action. (Courtesy: Raytheon)

AM/FM/TV BROADCASTING

NAB Hits Back at FCC

At the National Association of Broadcasters' (NAB) annual Vegas funfest, NAB President, Gordon Smith referred to the FCC's new National Broadband Plan as a "great spectrum grab" and warned that the TV band was not a "spectrum ATM," according to a report in *Broadcasting & Cable*.

NAB President Gordon Smith fights for broadcast spectrum rights at NAB convention in Las Vegas in April. (Courtesy: NAB)

He was just getting warmed up. The magazine, in an interview with Smith later, quoted the NAB leader saying the plan was like an offer from "the Mob that carried an implicit threat." Noting that the broadcast TV industry had already given up 25% of its spectrum during the digital TV transition, Smith was wary of the FCC's plan to take an additional 125 MHz of Over-the-Air (OTA) spectrum "voluntarily" over the next five years.

Embattled FCC Chairman Julius Genachowski speaks at the NAB convention in Las Vegas in April. (Courtesy: NAB)

Smith was also fed up with cable-TV taking high profile shows like the Olympics from network TV but not wanting to give broadcasters fair market value for retransmitting the popular programming.

As reported in the Hollywood Reporter, embattled FCC Chairman Julius Genachowski spoke to the crowd at the NAB show explaining that, "..."A real problem looms. At our current trajectory, the demand for mobile access will outstrip the supply, by a lot. Data from multiple sources submitted as part of our broadband record tell us to expect a 40-fold increase in mobile Internet demand over the next five years."

He advised that, "A broadcaster could contribute half of its capacity and share spectrum with another broadcaster in the market, continuing to broadcast their primary programming streams and more, while lowering their operating expenses and gaining infusions of capital."

LPFM Bill Might Include Ex-Pirates

Leslie Stimson, in her regular column in *Radio World* online, noted that new language introduced into the senate version of the Local Community Radio Act of 2009 (S.592) could allow former pirate radio operators to apply for the new low power FM (LPFM) licenses that would be made available should the bill become law. Pirate operators have been explicitly prohibited from receiving FCC licenses in previous legislation.

800,000 U.S. Households "Cut the Cord"

A report released in April by the Convergence Consulting Group, Ltd., titled, "The Battle for the North American Couch Potato," noted the changes in TV viewing habits in the U.S. and Canada, including online, DVR, cable-TV, satellite-TV and OTA-TV. It said, in part, that by the end of 2009, "…almost 800,000 U.S. households had cut their TV subscriptions (to rely solely on online, Netflix, OTA, etc.). We forecast cutters will grow to 1.6 million households by year-end 2011…"

Online Listening Slumps

It's hard to grow exponentially without taking a breather and that is what has apparently happened to online radio listening, according to an article in *Mediaweek* from early April. The report quoted Arbitron and Edison Research's "Infinity Dial Study."

The number of online radio listeners seems stalled at 43 million, nearly half the number that view TV online. The report also noted that more people (55% of the 43 million listeners) use Pandora or other online music services rather than streamed AM or FM stations (45%). The report said the overall number could jump dramatically this summer when Apple allows third party radio applications to play in the background while users use their phones for other tasks.

PUBLIC SERVICE: A TALE OF TWO CITIES

Cleveland Radio System Disarray

The Cleveland *Plain Dealer* reported in early April that the city of Cleveland, Ohio, after a year of looking at proposals to build a new public service radio system, will start over. The original Request for Proposals, seeking completely new systems, was a result of unending technical problems with its current aging system, purchased from Motorola in the 1990s.

But, the city may have nowhere to go. The only two companies that bid last year were Motorola and Morris Communications, formerly M/A COM, both of which have experienced all manner of problems where they've been implemented elsewhere.

D.C. Radio System Flunks Emergency

Most would imagine that a radio system designed to serve a city's police and fire services should be able to pass a simple power outage test. Yet, according to a report in the Washington *Post*, a power outage caused the Washington, D.C. system to shut down.

In the article, the mayor called it a "minor inconvenience" while representatives from the Fraternal Order of Police, the police union, called it a "disaster" and a "fiasco." Police resorted to using private cell phones for dispatch. The fire department fared better, according to the article, thanks to a previous agreement to use nearby county transmission facilities in Maryland and Virginia in case of emergency.

SATELLITE

Big Bonanza for Sirius/XM Top Brass

During the first quarter of 2010 Sirius/XM, the satellite radio monopoly, added more than 171,000 new subscribers compared to a loss of nearly half a million subscribers for the same period a year ago. It's certainly cause for celebration. Champagne glass in hand? *Laissez les bon temps roulez!*

It's time to give CEO Mel Karmazin a well deserved and kingly reward. How about a raise in salary to $1.5 million/year, a bonus of $7 million in cold cash, and stock options worth $35 million? The stock option is for 120,000,000 shares that Mel has the option to buy at $.43/share. Today the stock is worth about a buck. That would allow Mel to make a $70 million profit.

But, wait! Let's not leave out the rest of Sirius/XM top brass. Everybody gets a raise! The rest of the officers scooped up $3.5 million in salary, $4.5 million in cash bonuses, $3.6 million in stock awards, and $21 million in stock options.

Satellite radio must be really profitable, right? Not exactly. The company saw its first quarterly profit this year (it went on the air in 2001) but still founders in a sea of $3.3 billion in debt; suffers from lackluster auto sales (the source of new subscribers); skyrocketing competition from wildly popular MP3 players such as iPod, rapidly growing Internet radio, slowly developing (and free) HD-Radio, and now, the iPad, none of which existed in 2001. Ever try to put a champagne cork back in the bottle?

DISH Beats Panarex in Piracy Suit

The Sacramento *Business Journal* reported in mid-April that Dish Network was awarded a judgment in the amount of $121 million against Panarex, Inc., a company making Free-to-Air (FTA) satellite receivers and OTA-TV receivers. The suit concerned certain FTA receivers offered by the company through 2008 that could be easily reprogrammed to allow illegal reception of DISH Network programming without compensating DISH Network.

The judgment acknowledged the legitimacy of legal FTA receivers which cannot be so programmed. A company official told *MT* it continues to produce legal FTA and OTA receivers as well as a number of other satellite products such as LNBFs.

TiVo Pounds DISH in Patent Suit

Unfortunately for DISH Network, the previous story was the highlight of the first quarter of this year. DISH Network lost its appeal April, in federal appeals court, on a patent infringement charge in a long running case brought by the digital recording company TiVo. DISH was originally found guilty of violating certain patents held by TiVo in a jury trial and continued to appeal the judgment until its last appeal was denied. Now the company is forced to pay TiVo $300 million in damages and contempt sanctions in addition to the original $100 million it paid TiVo after the original appeals court ruling.

It could get worse for DISH because TiVo is asking the court to shut down the millions of now illegal DISH Network receivers that have the digital recorders at issue built-in. Such an order might cause wholesale defections of DISH subscribers to cable-TV or DISH competitor DirecTV, whose built-in DVR is not involved in the dispute. Industry rumors suggest that EchoStar (DISH Network's parent company with multi-billionaire Charlie Ergen at its head) may buy TiVo and solve all its problems.

FCC ACTION

FCC Internet Leash Yanked

The U.S. Court of Appeals, in a case widely believed to settle the issue of "net neutrality," ruled in April that the FCC lacks the authority to regulate an Internet service provider's network management practices. According to court documents, the case began in 2007 when several subscribers to Comcast's high-speed Internet service discovered that the company was interfering with their use of peer-to-peer networking applications which lets users share large files directly without going through a central server, which is said to consume great amounts of bandwidth.

A coalition of public interest groups and law professors complained to the FCC which ordered Comcast to stop interfering. Comcast did so, but challenged in court the FCC's authority to tell it how to manage its service. The result of that challenge led to the current public spanking of the Commission.

But, it's unclear how this decision will eventually play out. Some experts quoted in news reports believe the case signals the decline of FCC powers, especially in the area of emerging technologies, while others believe the case will lead Congress to write new laws narrowly defining Internet rules and thus hampering the, so far, unfettered growth of those same technologies.

FCC Northeast FM Pirate Sweep

The Northeast Region of the FCC's Enforcement Bureau was active in the 30 days prior to this being written, netting nine Massachusetts; five New York; three Rhode Island, and two Connecticut FM pirate radio station operators, as well as a slew of others throughout the U.S. including three AM pirates. All told, the FCC issued more than 40 Notices of Unlicensed Operation (NOUO) for the period.

The NOUO is typically the first message pirate broadcasters hear from the FCC, and the benign nature of the notice and disinterested form-letter quality seems to be interpreted by most as being about as important as that warning tag on the back of your mattress. Those receiving the Notice are given 10 days to respond, but that's usually taken as meaning 10 days to move the operation, which many do.

This month's QRO (high power) prize goes to the pirate FM station in Norwood, Massachusetts which FCC agents measured at more than 336,000 microvolts/meter at 62 meters. The legal limit for unlicensed Part 15 FM transmitters is 250 microvolts/meter at 3 meters.

The three AMers were on opposite coasts and one in Omaha, Nebraska. Still, there's no shortage of replacements for each unlicensed station shut down by the FCC. The availability of inexpensive broadcast equipment and how-to information online makes this a growth industry.

CB Op Cited for Advertising on Ch. 19

As if to prove that no one can escape the scrutiny of the FCC's army of field agents, the operator of a service station in Ohio was sent a Notice of Violation (NOV) for apparently advertising his station's services on CB channel 19 which is, of course, against the rules. According to FCC documents, FCC agents heard the operator soliciting for CB radio repair services, truck washes and tires for sale.

"Communications" is compiled by Ken Reitz KS4ZR (kenreitz@monitoringtimes.com) from news clippings and links supplied by our readers. Many thanks to this month's fine reporters: Anonymous, Rachel Baughn, Bob Grove, Norman Hill, Bob Margolis, and Larry Van Horn.

Military Communications & Electronics Museum

By Ron Walsh VE3GO

All graphics courtesy the author except where noted

There it was, right in front of me, a 4-rotor Enigma machine that was used for German encoding in World War II. Around the corner was the control panel for the RCAF shortwave station at Trenton. There was a fully equipped ANGRC 26A radio station, ready to be attached to a truck, and Collins Radio equipment that looked as if it was new. I then sat down at an amateur radio station that was connected to a 16 element log periodic antenna on a 50-foot tower!

No, this is not the ultimate dream of a radio enthusiast; just part of what you will see when you visit the Military Communications and Electronics Museum, at Canadian Forces Base, Kingston, Ontario. Although this museum is on a military base, it is open to the general public. In fact, everyone is encouraged to visit the museum. Admission is by donation only and anyone can enjoy the displays that cover the history of communications from early semaphore, telegraph, and radio, right up to satellites.

Although the focus is on military equipment, there are many displays of communications gear that you will not see elsewhere, including their unique collection of Morse code keys. It's easy to spend a lot of time at the museum!

I have had the privilege of participating in some of the programs the museum offers including operating the amateur radio station VE3RCS. I have also had the chance to provide some artifacts and equipment for the museum's collection. If you get the chance to see the storage area, the collection of communications gear is amazing. All the radio sets I could have dreamed of having, as a youngster listening to shortwave radio, are there.

My appreciation for the work that has been done there and the effort being put into the museum by the present staff has led me to write this article. There is no doubt they deserve a sincere thank you and some well deserved publicity for their efforts. It is important to make the general public aware that the museum is open to all who wish to see it.

Origins of Canadian Communications

The museum traces the origins of Canadian communications, when, after the South African War (1899-1902), the importance of signaling was recognized by the Canadian Army. The original Corps of Signals shared communications responsibilities with the Royal Canadian Corps of Engineers until 1919. The separate Corps of Signals received the Royal prefix in 1921.Their distinctive badge features Mercury, the speedy messenger of the Gods. In 1937, the Signal Corps School was moved to its permanent home at the new Vimy Barracks Kingston, Ontario.

A need soon arose to preserve and display the artifacts, equipment and documents relating to communications, and the museum itself began as the Royal Canadian Signals Museum in 1961. The name change to the Military Communications and Electronics Museum took place in 1976.

The collection rapidly outgrew the space in the base's Forde building, so fund raising for the present building began by 1987. Construction began in 1994. On December 1, 1995 the entire museum's collection was transferred to the new location – the Colonel A. E. Child building, so named for his contribution toward realizing the museum – and it officially opened on May 17, 1996. The museum is a sub unit of the Canadian Forces School of Communications and Electronics.

Major Dave Lawrence stands beside 4 Kilobytes of 32 Bit memory from a 1962 Mainframe. If it weren't for microchip technology, it would take 2,000 of these units to run Microsoft Windows. (Courtesy: C & E Museum)

I had the opportunity to interview the director of the museum, Mike De Noble, a veteran of 42 years service in signals. He was in the regular forces for 33 years and the reserves for 9 years. Having risen through the ranks, retiring with the rank of Major, he actually used the MACS HF console when it was at the Trenton, Ontario Air Base.

The museum is entirely self-supporting with all salaries paid for by donations. Some serving members of the forces pay a voluntary donation as well. Outside donations come from local businesses, the City of Kingston and even the Kingston Amateur Radio Club. The displays are rotated, and from May to September there is a new feature display. The museum tries to keep the displays as accurate as possible. For example, the prisoner of war display was actually designed by a prisoner of war.

The building was specifically designed as a museum and has already reached its capacity. It may be possible to convert a storage area to display some of the vehicles and add more displays on the main floor. However, plans are being developed to expand the museum in the near future.

I interviewed the curator of the museum, Annette Gillis, a very personable lady and a good example of the new generation becoming involved in history. Annette earned a BA in honors history, with minors in anthropology and Irish studies, and then completed a master's degree in public history at the University of Waterloo. Besides all her academic credits, she has worked at almost every job in a museum. She worked at the King's Landing historical site in Fredericton, New Brunswick; was a collections assistant at the Miner Museum in Cape Breton, and has even worked as a curator's assistant at the famous fortress at Louisburg, Nova Scotia. She has been involved in conservation restoration and archives, and a six month stay at the New Zealand National Army Museum gave her more background for her tasks here.

Annette told me there are over 10,000 artifacts stored here. In fact, a fifth of their collection is on loan to other museums for display. The World War I display has just been upgraded, thanks to a donation from the Weston family, a historically prominent Canadian family with a signal corps connection.

When asked what was needed here at the museum, Annette replied that more World War I equipment was being sought. They would love to get some Aldis lamps from that era for comparative purposes, along with some telescopes on tripods used to observe the semaphore flags

and signal lamps.

Equipment from the 70s 80s and 90s is also needed. Although some of this equipment is still in use, a lot of it is stored away in reserve units. Annette asks people not to destroy or junk surplus or decommissioned equipment before contacting the museum to see if it is of use to them. She also said she would like to add some equipment used in electronic warfare to the collection.

Annette mentioned the many requests they get for information. A person in Belgium asked why some Canadian-made equipment he had seen actually had Russian writing on the dial. It was one of the famous 19 set radios from World War II, some of which had been made for the Russians, thus, the appropriate labels.

You never know where Canadian equipment might turn up. I was asked to remind our American readers – and, in fact, readers around the world – that they might have some equipment of Canadian manufacture. This equipment may have been used by Canadian forces or by others, or may simply be period equipment they might wish to donate.

The museum is a recognized charity and can accept donations. Please contact the museum and make them aware of what you have. It might just be what they are looking for. I am positive all the work that went into forming the museum will only be augmented by Annette's efforts.

Public Education Efforts

I was recently invited to the graduation party that saw Annette become VA3VAI, thanks to the amateur radio course offered at CFB Kingston and presented by local amateur operators Les Lindstrom VE3KFS, Chip Chapman VA3KGB, and Rob Parker VE3RPF. I am sure her voice will soon be heard over the museum's own amateur station VE3RCS.

As a retired teacher, I am always interested in the programs offered by the museum. David McCarey has been in charge of the educational programs for three years. He is constantly improving and developing the material he offers. It has been my pleasure to help David with the Remembrance Day program and demonstrating the amateur radio station. Youngsters get to visit the displays and take an active part in the programs by wearing uniforms, building models and doing crafts.

David has earned degrees for teacher training and his enthusiastic efforts have been praised by many of the teachers who visit the museum, including my wife, Dawn. He can accommodate students of all ages with curriculum-based material covering many subjects, including history, science and geography. Programs are offered during school holidays, and the museum is part of the Kingston Association of Art Galleries Museum Camp in which young people visit a different area museum every day.

I would urge educators to contact David and arrange a visit to the museum. Students can experience, through artifact exploration, cultural material and history not available in the regular classroom. David can always use more volunteers and I can attest that doing so is a rewarding experience!

C & E Amateur Radio

Of course, my favorite location in the museum is the operational amateur radio station. Terry Murphy VA3TRM is a veteran of 34 years military service, a very active local amateur, and the custodian and license holder for the station. I am privileged to consider him a neighbor and a friend. Terry's career included many years as a lineman for the Signal Corps.

Terry explained about the vast amount of digging required when the forces wanted to bury telephone lines at installations. It took the work of many men and many hours to accomplish the task. Having grown up on a farm, Terry directed the base mechanics to build a small, single-furrow hand-held plow that could be connected behind a Jeep or similar vehicle. The furrows for the cables could be dug in no time and you can see this original item in the museum collection!

Northwest Territories relay station circa 1930s

The station has three call signs: VE3RCS and VA3SIG show the obvious connection to the corps of signals, and Terry also maintains the call VE3AHU that was the call of the late Art Blick, an amateur for over 60 years and a member of the Royal Canadian Signal Corps. The station also operates as CIW64 on the CFARS network, the Canadian equivalent of the MARS network in the United States.

The station had several locations on the base before settling in the museum, and I remember the small building where Keith Goobie VO1LX used to man the station and where Dave Lawrence VA3ORP did the initial station set up. Dave is noted for his knowledge of the famous 19 Set. Many amateurs maintain working 19 Sets and meet on the air the second Sunday of each month at1800Z on 7.270 MHz (+/- QRM).

VE3RCS has modern transceivers, amplifiers, antenna tuners and power supplies and operates from the 160 meter band to the 70 cm band. There is a complete HF antenna farm that includes trap dipoles for the low bands. My favorite is the 16-element log periodic antenna, 50 feet in the air, which covers from 3 to 30 MHz. It's great to work DX with this antenna and a kilowatt output!

The station is also a member of the Royal Signals Amateur Radio Society and provides contacts for their numerous awards. Terry is constantly improving the station with digital mode equipment being installed and a packet or gateway in the works.

You can find VE3RCS on the Transprovincial net every Thursday from 1000 to 1100 Eastern Time on 7.055 MHz* and QSL cards are available from the station. All amateurs are encouraged to visit the museum and operate the station, but be sure to bring a copy of your license to show the staff.

Mike De Noble at Trenton shortwave terminal

Upon entering the museum, you follow a time-oriented tour of communications from the 1860s to the present day. I enjoy the display of the telegraph station, as my father was a landline telegrapher and a member of the signals reserves during World War II. You can actually send Morse on the sounder to hear what it sounded like. The display of the early School of Signals classroom shows an original HRO receiver, among other items, that always catches my attention.

You can also see a typical military wireless station used in Northern Canada during the depression era. These stations greatly helped in opening up the Canadian north, handling countless messages for the people of that region. I am told it is the only branch of the forces that actually made a profit!

A prisoner of war camp is portrayed, including the radios made by the inmates. Actual spy radios carried by operatives behind enemy lines are also shown.

There is an extensive display of equipment: You can see restored spark gap units, 19 Sets, Hammarlund, Marconi, Collins and Racal units, among others. Complete mobile stations from various eras are also there for viewing. I particularly enjoy the displays of Morse code keys, radio tubes and military insignia. Telephone sets from the early to the modern can also be seen as is an actual Enigma machine used by the German U-boats to code message during World War II. And, that's only part of what you will see during a visit.

Before leaving, visitors may reflect at the Memorial Room, highlighted by the original molds used to design the statues at the famous Vimy Memorial, dedicated to fallen Canadian troops in France. It serves to remind all of us that many brave people, from many nations, have given their lives so that we may remain free people today!

This article is dedicated to the late Doug Hildebrand, former curator and a driving force behind the creation of the museum and the late Art Blick VE3AHU, who started using amateur radio for phone patches to home for soldiers in the Gaza Strip during the 1950s.

** U.S. amateurs do not have voice privileges at this frequency.*

MT

Radio Museums in North America

Compiled by Ken Reitz KS4ZR

While many famous museums such as the Smithsonian Institution have impressive displays of radio-related equipment of rare and historic significance, there are many smaller, mostly private, museums all over the U.S. and Canada that feature extensive displays of radios. Here, you'll see thousands of exquisite radios that have been lovingly restored, mostly by volunteers. Many museums charge no admission and those that do are usually under $10. Museum hours are somewhat erratic and, in many cases, it is a good idea to call ahead or check their web site for updates on public hours.

Some museums have "hands-on" displays, with many offering operating positions for licensed amateur operators, so don't forget to bring your license if you decide to include one of these museums in your summer vacation. Some, such as Antique Wireless Association in Apalachin, New York, have swap meets, flea markets or auctions that take place at the museum. Radio fans can purchase old radios with the proceeds of sales given to the museum. Check the website for details of such sales or auctions.

The current economy has not been good to many private museums; some have had to close their doors. If you do visit, give generously at the "donations" box. If you have such a museum near you, consider donating your time and talent to increasing its chances of survival. If you have excess equipment, consider making a donation to a museum near you; most qualify as tax-deductable institutions.

The following list of radio museums is by no means complete. All details were current as of this writing but, before you plan your trip, check out the web sites associated with the museum. If a museum has been left out, let us know and it will be added to the list.

Alabama Historical Radio Society
Museum located in the Alabama Power Building
600 North 18th Street
Birmingham, Alabama
www.alabamahistoricalradiosociety.org

American Museum of Radio and Electricity
1312 Bay Street
Bellingham, Washington (360-738-3886)
Open Wednesday through Saturday 11 AM - 4 PM; Sunday Noon - 4 PM. Admission: $5/adult; $2/children (aged 12 and under). Has its own low-power radio station KMRE 102.3 FM
http://amre.us

Antique Wireless Association Museum
2 Walnut Place
Apalachin, New York (585-657-6260)
Open May through September Saturdays 2 - 4 PM; Sundays 2 - 5 PM (closed July 4/5th and September 5/6th). Admission is free. Hosts AWA Bruce Kelly HF Net MWF at 9:30 AM ET on 3.837 MHz SSB. Publishes the quarterly AWA Journal, a well produced and authoritative quarterly magazine on all aspects of radio history.
www.antiquewireless.org/index.htm

Arizona's Radio and Television Museum (House of Broadcasting)
7150 East 5th Street
Scottsdale, Arizona (602-944-1997)
Summer Hours: Open 11 AM - 5 PM Monday through Saturday except holidays, closed Sundays. Admission is free.
www.houseofbroadcasting.com

California Historical Radio Society
Bay Area Radio Museum
KRE-AM 1400 Berkeley, California.
This is a work in progress that has suffered from the effects of the current economy. Full details are on their web site.
www.californiahistoricalradio.com/index.html

Children's Museum of History, Living History, Science and Technology
311 Main Street
Utica, New York (315-724-6129)
Operates WCML-AM in radio museum on the third floor. Open Monday, Thursday and Saturday 9:30 AM - 2 PM. Admission is $9/adults; $7/children ages 2-17; $8/seniors.
www.museum4kids.net/WCML_radio_rm.htm

Hammond Museum of Radio
595 Southgate Road
Guelph, Ontario Canada (519-822-2441 ext 590)
Open normal business hours Monday through Friday and weekends by request. Operates VE3HC memorial station.
www.hammondmuseumofradio.org

Museum of Broadcasting
3517 Raleigh Avenue
St. Louis Park, Minnesota (952-926-8198)
Open Wednesday through Friday 10 AM - 6 PM and Saturday 9 AM - 5 PM. Closed Sundays, Mondays, Tuesdays and holidays. Admission is $6/adults, $5/students and seniors. Exhibits include a 1912 spark gap transmitter; 1960s-era radio studio and extensive radio collection.
www.pavekmuseum.org

Museum of Radio and Technology
1640 Florence Avenue
Huntington, West Virginia ((304-525-8890)
Open from 10 AM - 4 PM on Saturdays and 1 - 4 PM on Sundays and 10 - 4 PM most Fridays from mid-April through October. No charge for admission but there is a conveniently placed donation box. Has amateur radio station WV8MRT.
http://oak.cats.ohiou.edu/~postr/MRT/index.htm

National Electronics Museum (History of the Nation's Defense Electronics)
1745 West Nursery Road
Linthicum, Maryland (410-765-0230)
Open 9 AM - 3PM Monday through Friday; 10 AM - 2PM Saturdays. No admission charge; free parking.
http://nationalelectronicsmuseum.org/index.shtml

New Jersey Radio Museum
A work in progress. If you live in the Dover, New Jersey area and want to aid in the building of a radio museum, go to this web site and learn more:
www.njrm.org/main.php?home

Pikes Peak Radio and Electronics Museum
6735 Earl Drive
Colorado Springs, Colorado (719-550-5810)
Open 10 AM - 5 PM Monday through Friday. Closed Saturday and Sunday. Admission is free.
www.pikespeakradiomuseum.com

Radio and Television Museum of Bowie, Maryland
2608 Mitchellville Road
Bowie, Maryland (301-390-1020)
Open Friday 10 AM - 5 PM and Saturday & Sunday 1 - 5 PM.
www.radiohistory.org/index.html

Society for the Preservation of Antique Radio in Canada
Kerria Drive Riverview Hospital
Coquitlam, British Columbia (604-777-1885)
Open most Sundays 10 AM - 4 PM. Repairs old radios and makes their bench available to those wanting to repair their own sets.
www3.telus.net/radiomuseum/index.html

Southern Appalachian Radio Museum
Asheville, North Carolina,
Open Fridays from 1-3 PM. On the campus of Asheville-Buncombe Technical Community College, Admission: $5/person, children under 13 free.
www.saradiomuseum.org

Vintage Radio and Communications Museum of Connecticut
115 Pierson Lane
Windsor, Connecticut (860-683-2903)
Open Thursday through Friday 10 AM - 3 PM, Saturday 10 AM - 5 PM, Sunday 1 PM - 4 PM Admission: $7/adult; $6/Seniors (60 years +); $5/Students; Children under 5 free. Has amateur radio station W1VCM available to licensed hams under W1VCM supervision.
www.vrcmct.org/index.html

Western Historic Radio Museum
Parish House, 109 South F Street
Virginia City, Nevada,
Open May through October from 1-5 PM. Admission: $5/adult; $2/children (under 15). Extensive displays of all manner of broadcast and amateur radio gear specializing in western U.S.-related radio.
www.radioblvd.com

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Frequency Coverage:
25.0000-512.0000 MHz., 764.0000-775.9875 MHz., 794.0000-823.9875 MHz., 849.0125-868.8765 MHz., 894.0125-956.000 MHz., 1240.0000 MHz.-1300.0000 MHz.

The handheld BCD396T scanner was designed for National Security/Emergency Preparedness (NS/EP) and homeland security use with new features such as **Fire Tone Out Decoder**. This feature lets you set the BCD396T to alert if your selected two-tone sequential paging tones are received. Ideal for on-call firefighters, emergency response staff and for activating individual scanners used for incident management and population attack warning. **Close Call Radio Frequency Capture** – Bearcat exclusive technology locks onto nearby radio transmissions, even if you haven't programmed anything into your scanner. Useful for intelligence agencies for use at events where you don't have advance notice or knowledge of the radio communications systems and assets you need to intercept. The BCD396T scanner is designed to track Motorola Type I, Type II, Hybrid, SMARTNET, PRIVACY PLUS, LTR and EDACS® analog trunking systems on any band. Now, follow UHF High Band, UHF 800/900 MHz trunked public safety and public service systems just as if conventional two-way communications were used. **Dynamically Allocated Channel Memory** - The BCD396T scanner's memory is organized so that it more closely matches how radio systems actually work. Organize channels any way you want, using Uniden's exclusive dynamic memory management system. 3,000 channels are typical but **over 6,000 channels are possible** depending on the scanner features used. You can also easily determine how much memory you have used and how much memory you have left. **Preprogrammed Systems** - The BCD396T is preprogrammed with over 400 channels covering police, fire and ambulance operations in the 25 most populated counties in the United States, plus the most popular digital systems. **3 AA NiMH or Alkaline battery operation and Charger** – 3 AA battery operation - The BCD396T includes 3 premium 2,300 mAH Nickel Metal Hydride AA batteries to give you the most economical power option available. You may also operate the BCD396D using 3 AA alkaline batteries. Unique Data Skip - Allows your scanner to skip unwanted data transmissions and reduces unwanted birdies. Memory Backup - If the battery completely discharges or if power is disconnected, the frequencies programmed in the BCD396T scanner are retained in memory. Manual Channel Access - Go directly to any channel. LCD Back Light - A blue LCD light remains on when the back light key is pressed. Autolight - Automatically turns the blue LCD backlight on when your scanner stops on a transmission. Battery Save - In manual mode, the BCD396T automatically reduces its power requirements to extend the battery's charge. Attenuator - Reduces the signal strength to help prevent signal overload. The BCD396T also works as a conventional scanner to continuously monitor many radio conversations even though the message is switching frequencies. The BCD396T comes with AC adapter, 3 AA nickel metal hydride batteries, belt clip, flexible rubber antenna, wrist strap, SMA/BNC adapter, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. Not compatible with AGEIS, ASTRO or ESAS systems. Order on-line at www.usascan.com or call 1-800-USA-SCAN.

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Bearcat 246T up to 2,500 ch. Trunktracker III handheld scanner	$214.95
Bearcat Sportcat 230 alpha display handheld sports scanner	$184.95
Bearcat 278CLT 100 channel AM/FM/SAME WX alert scanner	$129.95
Bearcat 248CLT 50 channel base AM/FM/weather alert scanner	$104.95
Bearcat 92XLT 200 channel handheld scanner	$109.95
Bearcat 72XLT 100 channel handheld scanner	$99.95
Bearcat BR330T up to 2,500 ch. Trunktracker III with Tone out	$274.95
Bearcat BCT8 250 channel information mobile scanner	$169.95
Bearcat 350C 50 channel desktop/mobile scanner	$104.95
AOR AR16BQ Wide Band scanner with quick charger	$199.95
AOR AR3000AB Wide Band base/mobile receiver	$1,079.95
AOR AR5000A+3B Wide Band 10 KHz to 3 GHz receiver	$2,599.95
AOR AR8200 Mark IIIB Wide Band handheld scanner	$594.95
AOR AR8600 Mark II Wide Band receiver	$899.95
AOR AR-ONE Goverment/Export sales only 10 KHz-3 GHz.	$4,489.95
Scancat Gold For Windows Software	$99.95
Scancat Gold for Windows Surveillance Edition	$159.95

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Frequency Coverage:
25.0000-54.0000 MHz., 108.0000-174.0000 MHz., 216.0000-224.9800 MHz., 400.0000-512.0000 MHz., 806.0000-823.9875 MHz., 849.0125-868.9875 MHz., 894.0125-956.000 MHz., 1240.0000 MHz.-1300.0000 MHz.

The handheld BC246T TrunkTracker scanner has so many features, we recommend you visit our web site at www.usascan.com and download the free owner's manual. Popular features include **Close Call Radio Frequency Capture** – Bearcat exclusive technology locks onto nearby radio transmissions, even if you haven't programmed anything into your scanner. **Dynamically Allocated Channel Memory** - Organize channels any way you want, using Uniden's exclusive dynamic memory management system. 1,600 channels are typical but **over 2,500 channels are possible** depending on the scanner features used. You can also easily determine how much memory is used. **Preprogrammed Service Search (10)** - Makes it easy to find interesting frequencies used by public safety, news media TV broadcast audio, Amateur (ham) radio, CB radio, Family Radio Service, special low power, railroad, aircraft, marine, racing and weather frequencies. **Quick Keys** - allow you to select systems and groups by pressing a single key. **Text Tagging** - Name each system, group, channel, talk group ID, custom search range, and S.A.M.E. group using 16 characters per name. **Memory Backup** - When power is lost or disconnected, your BC246T retains the frequencies that were programmed in memory. **Unique Data Skip** - Allows the BC246T to skip over unwanted data transmissions and birdies. **Attenuator** - You can set the BC246T attenuator to reduce the input strength of strong signals by about 18 dB. **Duplicate Frequency Alert** - Alerts you if you try to enter a duplicate name or frequency already stored in the scanner. **22 Bands** - with aircraft and 800 MHz. The BC246T comes with AC adapter, 2 AA 1,800 mAH nickel metal hydride batteries, belt clip, flexible rubber antenna, wrist strap, RS232C cable, Trunk Tracker frequency guide, owner's manual and one year limited Uniden warranty. For more fun, order our optional deluxe racing headset part **#HF24RS** for $29.95. Order now at www.usascan.com or call 1-800-USA-SCAN.

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The 2100-mile long Appalachian Trail from Georgia to Maine (Courtesy: Appalachian Trail Conservancy)

Hamming it up on the Appalachian Trail

By Joe Cuhaj

I have been a hiker and SWL since the early 70s. Since that time my interest in hiking has expanded to help organizations build and maintain hiking and backpacking trails. So, there I was one afternoon working on a trail with my friend Johnny Miller. Johnny is a hiker as well and a ham operator.

As we worked, we talked about our past hiking adventures, particularly on the Appalachian Trail. In 1921, a US Forest Service employee by the name of Benton MacKaye envisioned a wilderness footpath that would travel the spine of the Appalachian Mountains from Georgia to Maine. This dream was to become the 2,100-mile long Appalachian Trail that stretches from Springer Mountain in Georgia to Mount Katahdin in Maine.

Thousands have hiked or have attempted to hike this trail from end-to-end and those numbers increase each year. Those who try the hike do so for as many different reasons as there are hikers who climb to the top of Springer Mountain to begin the journey. But no matter who you are, if you can make the 6-month journey, it is a life changing experience.

As Johnny and I talked about the trail he casually mentioned that amateur radio operators are now bringing their gear along as they attempt to thru-hike from Georgia to Maine. Immediately an image of a guy hiking to the top of the trail's (and East Coast's) highest mountain, the 6,288-foot tall Mount Washington came to mind. I could see him with a 12-volt car battery strapped to his back, a 3-element Yagi antenna clutched in one hand, a Yaesu FT DX 5000 gingerly balanced in his arm, and his one free hand clutching the microphone in an attempt to QSO someone in Maryland.

Johnny quickly set me straight. Yes, there are many ham operators who drive to a spot near the trail or hike a short distance to a ledge or trail shelter along the A.T. to set up a voice station, but he was talking about bone fide "hiker hams" – ham operators who are actually hiking the trail and working all the 14 states the long path travels through, by using what is known as QRP (low power communications, usually below 5 watts).

Hendricks DC40B QRP Kit (Courtesy: Hendricks QRP Kits)

The idea is to use very low power but obtain the maximum amount of coverage. What makes QRP ideal for hiking is that the rigs are very small in size. If you scan the Internet you'll most likely see images of circuit boards tucked neatly into Altoids or tuna fish tins, both of which are perfect housings for a QRP kit.

The units themselves weigh only a few ounces, making them fit perfectly into the mantra of long distance backpackers – keep your load as light as possible. You have to remember that these "thru-hikers" are hiking over 2,000 miles with just about everything they need to survive hanging on their back. Bringing along a radio of any type is normally taboo, but as you can see, QRP rigs break that mold.

To further keep the weight down, these hams normally work the trail with CW, not voice. CW gear is not only lighter, but quick and easy to get on the air, while voice-operated rigs tends to be bulkier and heavier.

Most QRP hikers like to build their own transmitters using readily available plans found online. Some of the more popular plans include the Tuna Tin 2 and the Chickadee. Or, they opt to have a kit sent right to them with all of the parts they will need to build it, such as the Hendricks DC40B. Of course, speakers are not used; just a simple set of ear buds gets the job done.

Antennas are simple affairs as well. Lightweight antennas such as the PAC-12 aren't bad to pack along. When disassembled they are only 12-inches long. Still, antennas such as these can be rather bulky. For true portability and lightweight, many QRPers use a simple long wire made of zip cord. This is quite convenient in that it acts as both the antenna and lead-in.

With its small size, power requirements are small as well. Usually just a AA, AAA, or 9-volt battery will do the trick. Some hikers have gone the extra mile to go a little bit greener by using rechargeable batteries and powering them with portable solar chargers such as the Solio.

To get the most from working the trail, many hikers rely on a series of 2 meter repeaters. While most were not built specially for use on the trail, their location makes them ideal to work from all 14 states using small 2 meter handi-talkies. These are particularly useful for safety, as many areas have spotty cell phone coverage at best.

The exact number of amateur radio operators hiking and working the Appalachian Trail is not known, but the number is definitely growing as evidenced by the number of web pages that are springing up and the popularity of special A.T. awards and contests. Some of these contests include the Eastern PA QRP Club's "Appalachian Trail Award."

This contest is designed to promote hiking the trail from end-to-end and has several awards available, including the Trail Award which is presented when the ham works any station from all 14 states the trail travels through while they are actually on the A.T., and the Trail-to-Trail Award in which the ham must be on the A.T. and have 2-way communication with another station also on the trail.

I couldn't think of a more perfect adventure – hiking the tall peaks of the Appalachians such as Springer, Blood, Washington, or Katahdin, making camp for the night on a rock outcropping with a brilliant red sunset on the horizon, and taking out a QRP rig for a few quick QSOs with hams up and down the trail rooting you on toward the end of your adventure.

About the author:

Joe Cuhaj was born and raised in New Jersey just a stone's throw from the Appalachian Trail. Joe has been an SWL since the early 1970s. He is currently a software programmer, author, and freelance writer living on Alabama's Gulf Coast.

References:

Tuna Tin 2: **www.amqrp.org/kits/tt2/index.html**

Appalachian Trail 2 Meter Repeater Guide: **http://www.fred.net/kathy/at/hamguide.html**

Organizations:

American QRP Club: **www.amqrp.org**

Appalachian Trail Conservancy: **www.appalachiantrail.org**

QRP Homebuilder: **www.qrp.pops.net**

Eastern PA QRP Club: **www.n3epa.org**

Charger:

Solio: **www.solio.com**

Adventures:

Jim Cluett (W1PID): **www.mv.com/ipusers/w1pid**

All About Antennas Part 3

By Bob Grove W8JHD

Last month we discussed the many physical aspects of antenna design, not only in construction but in location. Now let's take a close look at some of the electrical considerations.

Matching the System

The term "impedance matching" always comes up when referring to an antenna and transmission line. To impede means to oppose, so what is being opposed in an antenna system?

When a battery is connected to a light bulb, the resistance of the filament is the impedance, dissipating the opposed energy as heat and light. Ohm's law reveals that there is a simple relationship between resistance, voltage and current. When a transmitter is connected to an antenna in free space, RF energy is radiated into space; the voltage and current are controlled both by the antenna's radiation resistance and any capacitive or inductive reactance which may be present.

Why does an open circuit like a dipole accept and radiate power? An antenna is a specialized form of transmission line; it is coupled to space, which has an impedance of 377 ohms. The center feed point impedance of a half-wave dipole, however, is much lower than that.

Resonance

The impedance of an antenna is a combination of radiation resistance, conductor resistance, and reactance. Radiation resistance is desirable; it's what accepts power and radiates it into space. Conductor resistance, however, wastes power as heat. Reactance opposes incoming energy; it is caused when an antenna is too long or too short at a particular frequency, so that when the wave (signal voltage) traveling along the antenna is reflected from the ends, it returns to the feed point "out of phase" with the incoming wave.

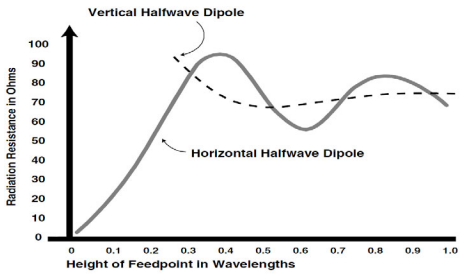
A half-wave antenna is naturally "resonant"; an arriving signal travels that half-wave length in half its cycle, then reflects back in the other direction, finishing that cycle when it returns to its starting point, the electromagnetic equivalent of a vibrating guitar string.

Measurements will reveal maximum current (and minimum voltage) at the center, and maximum voltage (minimum current) at the ends of the wire. A multiple-half-wave (full-wave, wavelength-and-a-half, etc.) antenna will have a standing wave on every half-wavelength section.

Radiation Resistance

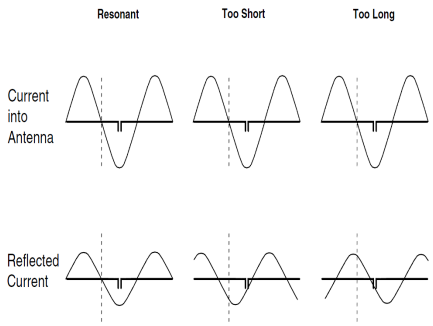
An infinitely-thin, half-wave dipole in free space (at least several wavelengths away from other objects) would have a center feed point impedance (radiation resistance) of 73 ohms. Constructed of normal wire the impedance is closer to 65 ohms; if thicker tubing, 55-60 ohms. This impedance rises as we move the feed point off center. If we use a folded dipole (See figure.) the feed point impedance rises to about 300 ohms.

Proximity to the earth's surface also alters



the feed point resistance of a horizontal dipole, typically dropping from 100 to nearly 0 ohms as the antenna is lowered from 0.33 wavelengths to the earth's surface, and fluctuating between 60 and 100 ohms at heights between 0.33 and 1 wavelength.

Vertical dipoles fare better, since their pat-



terns do not radiate directly downward where they would interact with the earth. Once elevated at least 0.25 wavelength, their impedance remains a relatively constant 70 ohms.

A vertical antenna with drooping radials has lower impedance, nominally 50 ohms; if those radials were horizontal (at right angles to the vertical element), the feed-point impedance would be about 35 ohms.

If 50-ohm coax is attached to an antenna's 50-ohm feed point, we have a perfect (1:1 ratio) impedance match, but if that 50 ohm coax is attached either to a 25 or 100 (50/25 or 100/50), is that bad? No. Is 3:1? No.

The simple fact is that if there is no resistive loss in the feed line or antenna (of course there always is), 100% of the generated power will be radiated by the antenna regardless of the mismatch.

What really happens with an impedance mismatch? Some of the signal voltage reflects back from the antenna junction through the coax to the transmitter where it is re-reflected and eventually radiated into space. The higher the voltage (that is, the worse the mismatch), the more power is absorbed by the resistive insulation, heating it. That's where low-loss coax is important. An impedance mismatch does not produce radiation from the feed line.

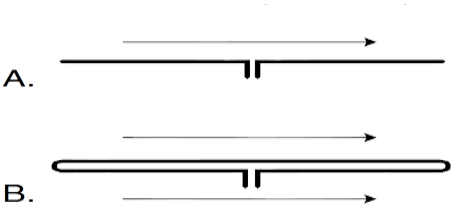
When receiving, all signal voltage gathered by a perfectly matched antenna is fed to the receiver, but with a mismatch, the reflected signal is radiated back into space. In practice, this is usually of minor consequence, especially at HF and below, where atmospheric noise is a dominant influence on signal interference.

The Transmission Line

In the early days of radio when open-wire transmission lines were common, the voltage fields produced by standing waves would light up bulbs and deflect meters brought near the lines; nowadays, with the near-universal use of coaxial cable which encloses the electrostatic fields, such measurements are not as easy.

Connecting an unbalanced line (coax) to a balanced antenna can cause RF currents to flow on the outside of the line, but these are not standing waves. So what gives a transmission line its characteristic impedance (surge impedance)? A feed line can be considered as a radio-frequency, low-pass filter consisting of an infinite number of series inductances shunted by an infinite number of parallel capacitances.

The impedance of this distributed network



is theoretical, based upon the dielectric constant of the insulation, the spacing of the conductors, no losses, and infinite length.

While the most common feed line impedances are 50, 75 and 300 ohms (TV twin lead), there are more than two dozen commercially-available impedances from 32 to 600 ohms.

So why 50 or 75 ohms?

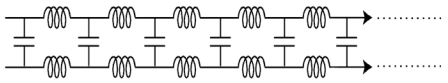
Why have we chosen impedance standards like 50 and 75 ohms for coax? For transmitters, the best power-handling capability is at 77 ohms, while the best voltage tolerance occurs below 30 ohms. 50 ohms is a good compromise and it matches several standard antenna designs.

For receiving purposes, 75 ohms is optimum for low coax losses, so it was adopted by the cable TV industry. Conveniently, it also matches several antenna designs.

The impedance a transmitter or receiver "sees" when it is mismatched to a length of transmission line connected to an antenna is a composite of the length of the line along with its losses, the SWR (see "Traveling Waves" below), and the load (feed point impedance of the antenna to which it is connected). If they are all properly matched, however, the impedance is determined only by the characteristic of the line.

Magical line lengths

Trick No.1: The impedance measured at the bottom of an electrical-half-wavelength transmission line (or any whole-number multiple of a half-wavelength), regardless of the characteristic impedance of the feed line, is the feed point impedance of the antenna.



For example, if, at some frequency, an antenna has a feed point impedance of, say, 143 ohms, then we will read 143 ohms at the bottom of a 50-, 72- or 300-ohm, electrical half-wavelength line connected to it.

Keep in mind that this is an electrical half-wavelength; we must multiply the free-space half-wavelength by the velocity factor of the coax. For example, a half-wavelength at 14 MHz is 33 feet; using coax with a velocity factor of 66% would mean that you would actually cut the line to a length of 22 feet.

Trick No.2: We can use a quarter-wavelength piece of transmission line as an impedance-matching transformer using the formula:

$$\text{stub} = \sqrt{\text{Z feedline x Z load (antenna)}}$$

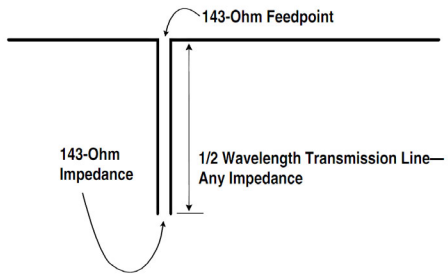
For example, by substituting actual values in the solution below, if we wish to attach a 100-ohm antenna to a length of 50 ohm cable, we can insert a quarter-wavelength matching stub of 70 (often marked 72 or 75) ohm cable.

$$\sqrt{50 \times 100} = \sqrt{5000} = 70.7 \text{ ohms}$$

Don't forget to multiply the free-space quarter-wavelength by the velocity factor and shorten the length of the cable accordingly. For example, a quarter-wavelength at 14 MHz is 234/14, or 16.7 feet; using coax with a velocity factor of 66%, the actual physical length would be cut to 11 feet.

If the line needs to be physically longer, use odd multiples of the quarter-wavelength and the transformation will remain the same.

Off-Center-Fed Dipole



But remember, most antennas exhibit a very narrow frequency bandwidth for a given impedance, so all this magic occurs only around one frequency; on single-element antennas like dipoles and verticals, it also works on odd-harmonic multiples, although the match degrades as we increase the number of multiples.

Remember as well, to take into account the velocity factory of the coax. For example, if a half-wavelength at 7 MHz is 66 feet in free space, then the electrical half-wavelength of coax with a velocity factor of 67% would be 44 feet.

Standing Waves or Traveling Waves?

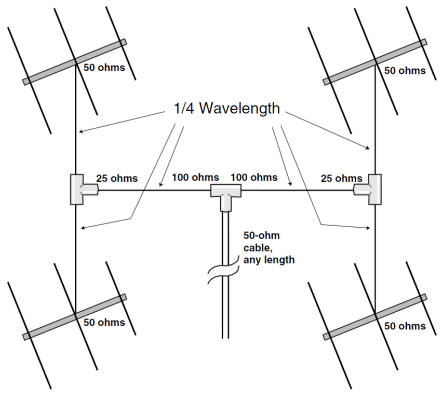
When the system is non-resonant, the waves reflect back from any point where the impedance changes, passing across each other in phase. Typically, these changes occur where the transmission line attaches to the antenna.

Early instrumentation could not detect which waves, forward or reflected, were being measured; their composite voltage was shown on a voltmeter, periodically distributed along the transmission line. They were assumed to be standing waves and the name has stuck.

The comparison of those summed voltage peaks to the minimum voltages interspersed between them is called "voltage standing wave ratio" or "VSWR." Engineers prefer to measure the "voltage reflection coefficient," the comparison of the reflected voltage to the incident voltage at any one point on the line.

Since power (measured in watts) is a product of voltage times current, as the current rises, the voltage falls (and vice versa); thus, the current peaks are half way between the voltage peaks. The ratio of the current peak to minimum is the same as that of the voltage, so "VSWR" is usually shortened to "SWR" to accommodate both units.

For example, if a 200-ohm resistive antenna feed point is attached to a 50-ohm line, we would have a 4:1 SWR. The presence of inductive or capacitive reactance adds further to an antenna's impedance.



Total Impedance = $\sqrt{100 \text{ ohms} \times 25 \text{ ohms}}$ = 50 ohms

When transmitting, the high voltages produced by high SWR may arc across the feed line insulation or tuning components, and high current may waste energy by heating the feed line conductors. Since these are stationary points on the line for any particular frequency, the transmitter (or matching device) may experience either high voltage or high current, depending upon the length of the line.

In a receiving system, antenna-to-transmission-line mismatch will also produce losses in the transmission line; additionally, any impedance mismatch between the receiver and the antenna system will reflect power back to the antenna where it will be re-radiated back into space.

Feedline loss

Single-wire feed, popular in the early 1900s but now virtually abandoned, matched best at high-impedance feed points (hundreds or even thousands of ohms); it was commonly used to off-center-feed antennas in the early days of radio, often with an SWR exceeding 10:1, but they were efficient radiators.

The lowest-loss transmission line commercially available is open-wire, parallel feed line known as "ladder line." It accommodates high power and high SWR with virtually no loss.

Disadvantages of open-wire feeders include:

(1) A separation requirement between it and any nearby moisture or metal by two to four times the separation of its two wires to avoid some SWR increase resulting from interaction with its unenclosed field;
(2) Unbalancing the line by allowing one wire to come closer than the other to nearby metal or moisture;
(3) Inability to bend at sharp angles without additional reflective losses;
(4) Impedance mismatch when attaching to standard low impedance antennas and transmitters (except when used in multiples of a half-electrical-wavelength long at specific frequencies);
(5) Balanced matching requirements when used with unbalanced equipment (like every transmitter made!);
(6) Vulnerability to electrical noise pickup if slightly unbalanced;
(7) Changes in characteristic impedance from rain, ice and snow;
(8) and rarity of parallel-line connectors on radio equipment.

Solid-dielectric, parallel feed line like TV twin lead may also be used for receiving and low-power transmitting provided all the caveats regarding open-wire feeders are observed.

Because its closer conductor spacing confines its field more, it may be brought within two or three inches of nearby metal or moisture. But the plastic insulation on inexpensive TV twin-lead disintegrates with time, collecting moisture and residue in its cracks, making it lossy.

Coaxial cable, on the other hand, may approach the efficiency of open wire, may be run underground or through metal pipe, is electrical-noise resistant, and mates easily with conventional connectors.

Here are the reasons that most coax is lossier than open-wire feed line:

(1) Its conductors are smaller, offering more resistance to waste the current as heat.
(2) The dielectric (insulation) surrounding the conductor dissipates some power; the higher the frequency, the higher the dissipation.

These two factors explain why large diameter, foam dielectric, short length, coax cables are preferred, especially for transmitting. There is also a safety reason: coax doesn't radiate its energy.

Of course, mammoth coax is wasted if smaller will do; after all, in house wiring, we

don't use enormous #4 bus wire when #12 safely passes all the current that is required.

So what is the best coax? Generally speaking, the bigger the better, with aluminum-sheathed hard line taking the prize. But will you know the difference between that and, say, Belden 9913, foam dielectric RG-8/U, RG-213/U or RG-214/U? Not unless you are running at least 100 feet at 1000 MHz or higher, or are transmitting more than 1000 watts.

For receiving purposes, or for transmitting up to 200 watts, it's even easier. Since we aren't developing high voltages, we can use smaller-diameter cable, just so long as it's not lossy.

Generally speaking, coax with a high velocity factor rating suffers the least loss. Below 30 MHz use RG-58/U, RG-59/U, RG-6/U, or RG-8/X for runs of up to 100 feet. For VHF/UHF to 1000 MHz, use any of these but the RG-58/U.

Don't let 70 ohm (instead of 50 ohm) impedance throw you; you won't hear the difference for receiving, and the impedance mismatch for a 50 ohm transmitter is only 1.4:1 which is inconsequential, resulting in a loss of less than 0.2 dB, which is imperceptible.

Generally speaking, the thinner the coax, the poorer the cable. Skinny RG-174/U should be used only for the shortest runs (a few feet).

Never use shielded audio cable in place of coax for radio frequency work; it is very lossy, has dreadful shielding, inviting interference during reception, and radiation during transmission. Its reputation for causing radio-frequency interference (RFI) when used to interconnect digital accessories is notorious!

But even good coax deteriorates with time; foam-dielectric coax, initially superior in performance, loses grace first, falling victim to moisture intrusion. Many experts (especially cable vendors!) recommend replacing coax every five years.

So, how can we tell if the coax is still good? One way is to short-circuit the far end of the cable and attach the near end to an SWR meter which, in turn, is connected to a low-power transmitter. The short will reflect 100% of the power reaching it, sending it back to be registered as reflected power. The higher the SWR, the better, because it means that energy is not being absorbed along the way. Replace coax that shows a short-circuit SWR lower than 3:1.

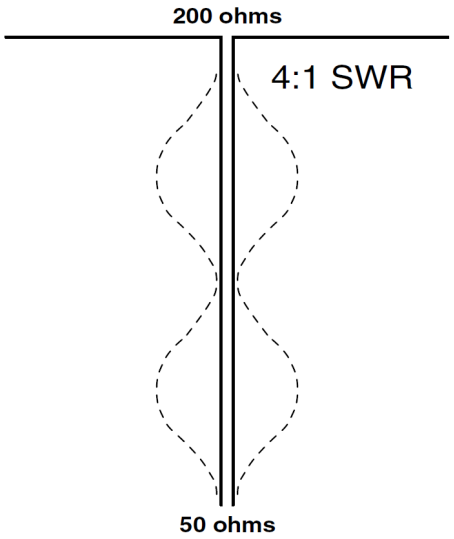
An easier test is to attach an ohmmeter on its high resistance scale across the shield and center conductor of the coax, leaving the far end open. There should be no reading on the meter (several megohms resistance). If there is a reading, the lower the resistance, the worse the coax. It may be showing the consequences of water intrusion or corrosion.

A high SWR between the feed line and antenna may appear as a low SWR at the transmitter. Corroded or loose connectors, lossy cable and other resistive agents can all contribute to a deceptively low SWR reading.

Since no cable is 100% efficient, the SWR measured at the transmitter will always be lower than the actual mismatch at the antenna; the poorer (lossier) the cable, the lower (and more misleading) the reading.

Only by connecting an SWR meter directly to the antenna feed point can we get a true SWR reading. Use good cable and that SWR difference is but a few percent.

So how does transmission line loss in decibels translate to percentage of power loss? If system impedances are matched properly, a 1 dB loss uses up 20% of the power; 3 dB represents 50%; and 6 dB attenuation means that 75% of the power is being used to heat the coax, whether transmitting or receiving.



In an unmatched system, line losses are even worse. High-SWR voltages dissipate more power in the transmission line's dielectric (insulation breakdown), current peaks dissipate more power in the conductor (resistive losses) and both effects are aggravated by rising frequency. The result is that power is being wasted as heat.

For example, a 6:1 SWR in 100 feet of RG-8/U at 14 MHz produces only a 1 dB loss, but at 450 MHz it becomes 6 dB, and at 900 MHz, 8 dB. With poorer-quality cable, losses are much worse. It pays to use good cable!

Keep in mind that these are coax losses; if you use open-wire feeders, the loss at 10:1 or even 20:1 SWR is insignificant. Such high SWR was present on early, micro-power earth satellites, but we heard those fine 23,000 miles below, demonstrating once again that SWR alone has nothing to do with radiation efficiency.

Contrary to popular myth, high antenna SWR does not radiate any more harmonics or television interference (TVI) than a 1:1 SWR, assuming that the transmitter is properly tuned on frequency.

Keeping SWR to a minimum by proper transmission-line impedance matching is a preventive against damage, especially to modern transceivers with marginal power specifications.

Automatic power-reduction circuits often kick in with an SWR as low as 2:1, making matching a requirement to achieve full output power.

Tuning the System

Antenna tuners, antenna tuning units (ATUs), transmatches, couplers and matchboxes are different names for the same thing: combinations of adjustable capacitors and coils to compensate for inductive and capacitive reactances in the antenna system. Transmatches (the preferred term) also provide adjustable impedance transformation between the receiver or transmitter and line, and some provide balanced-to-unbalanced matching as well.

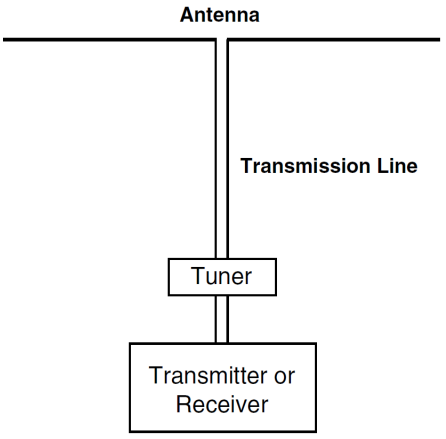
Every length of metal has some frequency or frequencies at which it is naturally resonant; that is, the inductive reactance equals the capacitive reactance, thus mutually canceling the reactance and leaving only the radiation resistance. If an antenna is too long for it to be naturally resonant at some desired frequency, we say it is inductive; a series capacitance can "tune out" that inductive reactance which opposes the incoming RF power.

Conversely, an electrically-short (capacitive) antenna can be adjusted by a series inductance. Contrary to a popular notion, a loading coil does not "add the missing length" to a short antenna; its inductive reactance cancels the antenna's capacitive reactance. We can also neutralize these reactances with a transmatch connected at the transmitter output.

Quoting antenna guru Walt Maxwell, W2DU, when the transmatch is properly tuned, "...the entire system is made resonant...all reactances in the system are cancelled...the net reactance is ZERO! In addition, by obtaining a conjugate match at the antenna tuner, a conjugate match is inherently obtained at any other junction in the system where a mismatch existed prior to obtaining the match with the tuner."

A transmatch is adjusted to provide capacitive and inductive values of equal magnitude, but of opposite phase, to the returning reflected power, thus re-reflecting it back toward the antenna in phase with the transmitted power.

We don't electrically alter any reactance in the antenna system, we merely neutralize their effects, thus matching all impedances in the process. All that is left is the antenna's radiation resistance, so all power is radiated.



This "tuned feed-line" approach can be used with single wire, open parallel line, twin lead, or coax equally well. Since a transmatch is typically connected between the transmitter (or receiver) and feed line, it can only impedance-match those two points; it has no affect whatsoever on matching the feed line to the antenna. We would need to connect the transmatch between the feed line and antenna feed point to produce a match there.

continued on page 72

SW Radio from Both Sides of the Microphone

By Jeff White, Founder and General Manager, WRMI Radio Miami International

(All photos and graphics are courtesy the author unless otherwise noted)

It was sometime in early 1972. I was 12 years old and living in my native Indianapolis, Indiana. My parents had bought a new 12-band Ross Electronics portable radio (I still have it!), and one night I became curious about the two bands on it marked SW. Casually tuning through the 4-12 MHz band, I came upon an English language program from Radio Deutsche Welle in Germany. "How cool," I thought to myself, "A program from Germany and it's in English!"

I listened to the program, which I believe was over an hour long in those days, and I remember hearing Larry Wayne's segment with tidbits about life in Germany and his reference to "the cat what am." I enjoyed the program so much that I started listening to it every night at the same time, and never changed the dial from that 49-meter band frequency.

Then one night I found that someone had changed the dial position, and I had to do some major searching on the shortwave bands to find Deutsche Welle again. In the process, I accidentally ran across Radio Prague in English. Now that was *really* cool! I had found a station from a communist country in English, right there in the conservative Midwestern U.S. in the middle of the Cold War. I was fascinated.

Shortly thereafter, I discovered Radio Moscow in English, which was just about the maximum excitement I could imagine at that time, with programs like Joe Adamov's "Listeners Mailbag."

Most of my friends and family thought I was little strange, wanting to listen to political propaganda from Eastern Europe. But, I thought it was neat to hear broadcasts direct from "the other side," even if I didn't agree with them politically.

On the following nights, I came across some excellent English programming from Radio Netherlands, the "DX Party Line" from HCJB in Ecuador, and broadcasts in English and Spanish from Radio Havana Cuba, which fascinated me as I was learning Spanish in school at the time.

Bob Zanotti (formerly of Swiss Radio International) with Jeff at the European DX Council Conference in Lugano, Switzerland in 2007

How Shortwave Changed my Life

Little did I know back then in 1972 that one day many years later I would meet Larry Wayne while touring Deutsche Welle, and that I would win a piece of the Berlin Wall in a Deutsche Welle contest. I had no idea that I would be re-broadcasting Radio Prague's English and Spanish broadcasts on my own shortwave station in Florida. I certainly never imagined that I would meet and chat with Joe Adamov at a *Monitoring Times* Convention in Atlanta, or that I would be a regular contributor to Radio Netherlands and HCJB's "DX Party Line." And, I had no idea that one day Cuban government officials would call me a CIA agent for selling airtime to Cuban exile organizations in Miami to broadcast on shortwave to their countrymen!

Jeff and George Wood of Radio Sweden exploring the island of Grand Canary during the 1993 EDXC Conference in the Canary Islands

Yes, shortwave radio has changed my life ever since that day in 1972 when I first became a shortwave listener (SWL). I became an avid SWL, tuning in daily to broadcasts from around the world. It gave me a unique perspective on the news, culture, languages and music from around the world. Two or three years after I started listening, some of the DX programs that I heard convinced me to start sending reception reports to stations and collecting QSL cards. Then my mailman thought I was kind of weird, as I received letters and packages from all over the world, including such places as China, Albania and Russia.

One summer my parents took me on vacation to Montreal. I insisted on stopping at Radio Canada International and trying to visit the station. Much to my surprise, Ian McFarland welcomed me to watch a taping of a *Mailbag* and DX program. I sat there watching the whole process and it was at that moment that I decided that my career would be shortwave broadcasting. Little did I know that Ian McFarland would become one of my closest friends and that we would work together for many years organizing radio conventions and working on the Handicapped Aid Program in North America, among many other projects.

Han Hee Joo of Radio Korea with Jeff and Thais in Seoul in 1999

It would be a while before I would get involved in shortwave broadcasting, though. In the meantime, I studied journalism at Northern Illinois University, working at the same time as a news reporter for the university's public radio station WNIU-FM, and at times for the National Public Radio network. I was one of the organizers of a DX club in the Chicago area, and produced a weekly program segment on their behalf for Clayton and Helen Howard on HCJB's "DX Party Line." That was actually the beginning of my shortwave broadcasting career.

Meantime, I worked as the public relations chairman for the Association of North American Radio Clubs (ANARC), which involved organizing or co-organizing the annual ANARC shortwave listener conventions in different parts of North America. Lots of shortwave broadcasters attended these meetings, so I had the chance to get to know shortwave personalities like Bob Zanotti of Swiss Radio International, and many quickly became good personal friends of mine.

The Radio Earth Years

While working at WNIU, I met some other station employees who, coincidentally, were also shortwave listeners. One day I mentioned my idea of starting a commercial shortwave station to a fellow WNIU reporter whose father was in advertising at Sears in Chicago and

Jeff, Thais and Ian McFarland touring Vancouver, near Ian's current place of residence

we decided to pursue the idea. We met with advertising officials at various multinational companies, all of whom really liked the idea of advertising on shortwave radio.

This encouraged us to move forward with the idea, and a few years later we had secured sponsorship from the Curacao (Netherlands Antilles) Tourist Board for a daily one-hour shortwave program which would be broadcast via Radio Clarin, a 50,000-watt privately-owned shortwave station in the Dominican Republic. We formed a company called Radio Earth and started a program called "The World."

We decided to broadcast our program from Curacao, so in 1981, an associate producer and I went there with a semi-portable studio that we set up in the Curacao Hilton. We recorded the bulk of the program at our studio in Curacao and put it on a flight each afternoon to Santo Domingo in the Dominican Republic, where our partner – the very popular shortwave celebrity Rudy Espinal of Radio Clarin – picked up the tape and added a newscast and his own segment of music and tourist information called "This is the Caribbean."

"The World" included feature reports from Curacao and from various well-known shortwave personalities in other countries such as David Monson (formerly of Belgian Radio and TV) and Adrian Peterson of Adventist World

Jeff reviewing listener letters that arrived at Radio Earth's studio in Curacao, Netherlands Antilles

Jeff and Rudy Espinal in Curacao during the early days of Radio Earth

Radio-Asia. The first day we had everything completely scripted. But the second day we were very short on time, and we had to ad-lib everything with only a program outline to go by.

We didn't know if this "free style" would be liked by shortwave listeners, and we really had our doubts after the first several days when we had received absolutely no listener response (there was no e-mail back in those days!). However, a week or two after we began the program, the mailman came to our studio at the Hilton with a large bag full of letters from listeners around the world. The comments were all positive, so we knew we were doing something right.

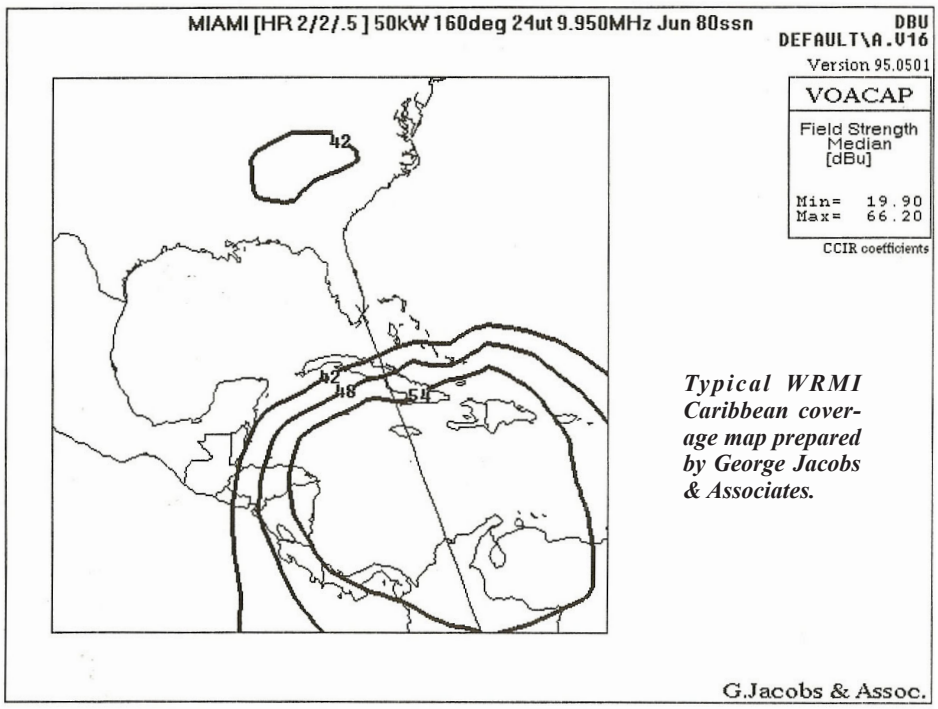
Radio Earth quickly became one of the most listened-to shortwave programs in North America. We couldn't have been happier with the listener response. But, beyond the forward-thinking executives of the Curacao Tourist Board, we couldn't convince major advertisers to buy spots or sponsor our programs. The problem was that their advertising agencies didn't want to touch anything that didn't have certified listener statistics, such as Arbitron ratings, and that was unfortunately out of the question for shortwave radio.

A Galcom solar-powered receiver fix-tuned to WRMI's frequency of 9.955 MHz.

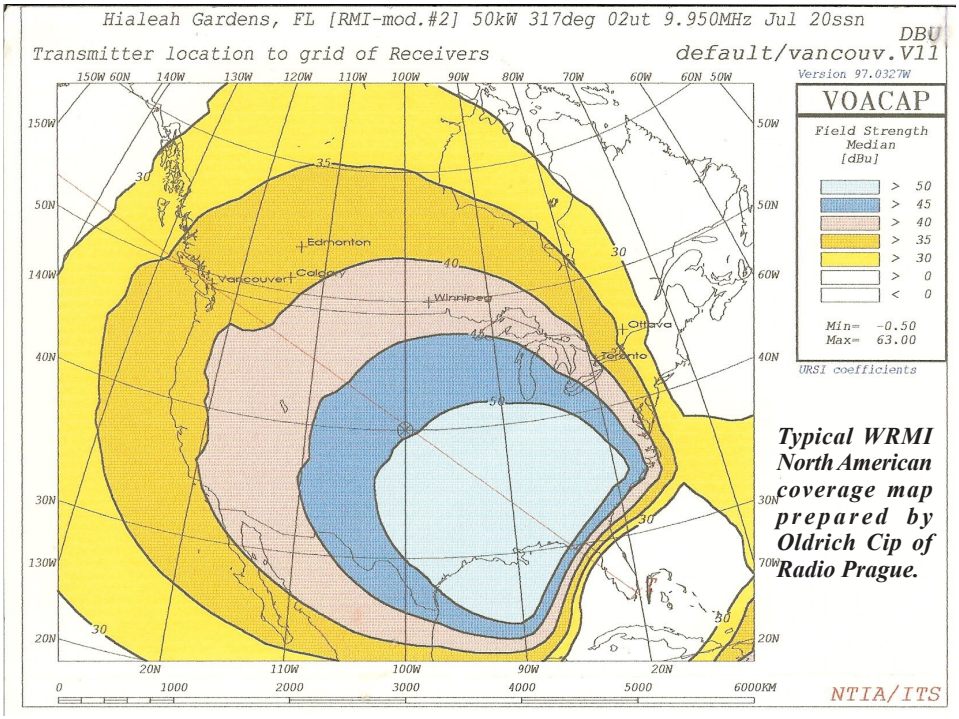
Next phase: Radio Discovery

It quickly became obvious that we couldn't finance our program with spot advertisers. It would be necessary to have a station of our own on which to sell airtime to outside organizations, and then use this income to finance our own programming. For various reasons, Radio Earth was not able to do this. So, in 1986 I went into business with Rudy Espinal in Santo Domingo and a few other investors, and we put a small one-kilowatt shortwave station on the air from Santo Domingo called Radio Discovery.

Despite its small power, Radio Discovery was heard throughout the Americas and much of the world. The station operated with an informal permit from the Dominican telecommunications administration and a promise from the leading presidential candidate that once he was elected, he would help us secure a permanent license,



Typical WRMI Caribbean coverage map prepared by George Jacobs & Associates.



Typical WRMI North American coverage map prepared by Oldrich Cip of Radio Prague.

despite an official freeze on new radio licenses. To everyone's surprise, our candidate lost the election and it looked like it would be very difficult to get an official license, so we shut the station down.

From Santo Domingo, I went to Florida and began doing a lot of freelance reporting for networks including National Public Radio, NBC and the Christian Science Monitor World Service. I was based in Miami, but traveled around the Caribbean and Latin America. I covered a number of major news stories from Panamanian President Manuel Noriega's trial in Miami to Hurricane Hugo's devastation in St. Croix. There I spent a rainy night in a hammock on a Danish schooner waiting out the curfew so I could get a military flight to San Juan where the telephones were working and I could phone in my reports.

I very much enjoyed my work with the Christian Science Monitor World Service, and I lamented its closure, since it had quickly become one of the foremost news services on shortwave, rivaling even the BBC.

During the 1980s, I also had the opportunity to do a series of shortwave audience research studies in many countries of the Caribbean and Latin America. These reports were sponsored by the Voice of America, Radio Canada International, the BBC, Deutsche Welle, Swiss Radio International, the Christian Science Monitor and others.

As part of these research reports, I had the great pleasure of looking up shortwave listeners in countries such as Venezuela, Colombia and Nicaragua to interview them about their listening habits, the radios they used, the types of programs they liked, etc. I'll never forget being invited to a shortwave listener's home on stilts in the middle of an oilfield in Trinidad, where, much to my surprise, he showed me his prized Yaesu FRG-7 receiver and a Radio Earth QSL card that I had signed and sent to him a few years earlier!

WRMI's transmitter building and antennas are located in Hialeah, a suburb just northwest of Miami.

Radio Miami International

Eventually I was asked by the Cuban American National Foundation to help them establish a shortwave service, buying airtime on existing stations like Radio Clarin in Santo Domingo and WHRI in Indiana. This led to a fairly active brokerage business, as many other Cuban exile organizations also wanted to beam shortwave programs to the island. We made it possible for them to do so at a reasonable price, without having to set up their own stations.

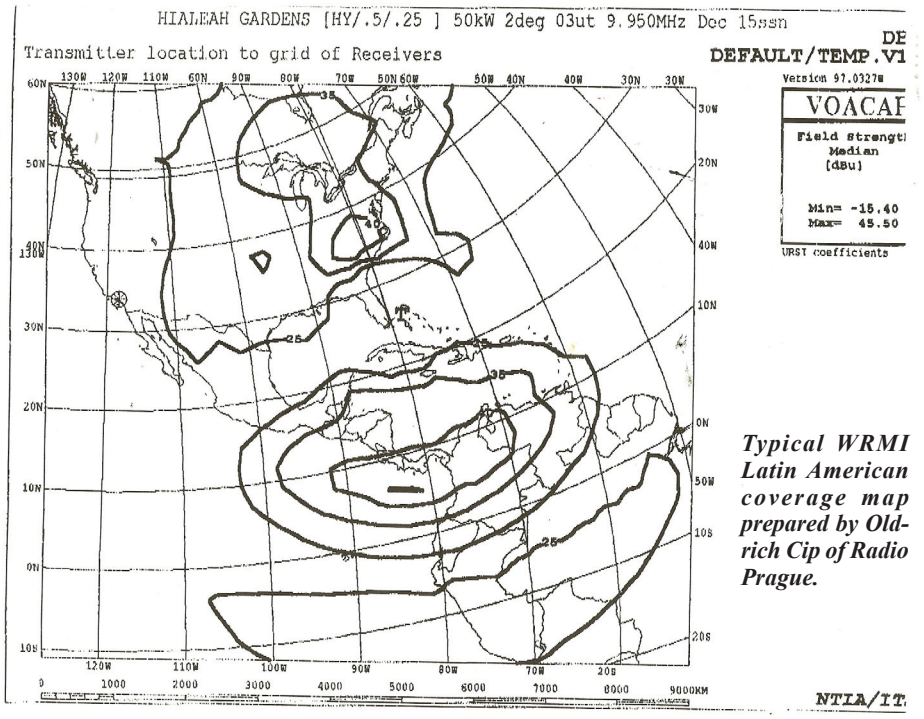
In those days – the late 1980s and early 1990s, it was hard to find shortwave stations with a good signal in the Caribbean that were willing to sell airtime to outside organizations, and the demand became greater than the airtime available. It wasn't long before I saw the need to put my own station on the air, which I eventually did with the help of a local engineer named Kiko Espinosa and a few other Miami partners. (As a side note, Kiko passed away in 2005, and his son-in-law Raul Mena is now our chief engineer.)

WRMI's main studios and offices are located in this building in Fontainebleau Park, just west of Miami International Airport.

By 1994, we had WRMI – Radio Miami International – on the air, using Radio Clarin's old 50-kilowatt transmitter which we had purchased from them, shipped to Miami, and largely rebuilt. We received FCC permission to use 9955 kHz, which we still use today.

Besides broadcasting Cuban exile programs, WRMI broadcast Haitian President Jean-Bertrand Aristide's "Radyo 16 Desanm" programming to Haiti when Aristide was in exile in the United States, as well as a large number of religious programs in Spanish and English and a variety of other political, cultural and commercial programs. Over the years, we have had sports programs, musical programs of many genres, programs produced by children and even by the residents of a mental institution in South America.

We have also served as a relay station, re-broadcasting programs of Radio Prague, Vatican Radio, United Nations Radio, World Radio Network and others. WRMI airs many DX programs in English, Spanish, Portuguese and Italian, and we have always tried to maintain an excellent relationship with the shortwave



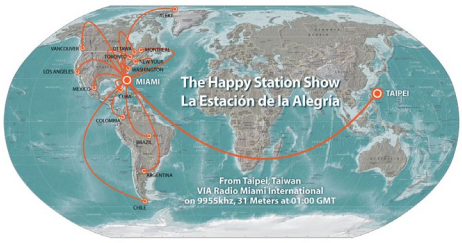
Typical WRMI Latin American coverage map prepared by Oldrich Cip of Radio Prague.

Shortwave listener Raphael Abdias of Ouanaminthe, Haiti proudly holds a WRMI sticker in front of his home with all of his family members.

listening/DXing community, even attending SWL meetings in North America, Mexico and Europe.

NASB, HFCC, DRM and the Future of Shortwave

Many people are not aware of it, but the privately-owned shortwave stations in the United States have a professional organization called the National Association of Shortwave Broadcasters (NASB). Soon after WRMI went on the air, the NASB asked us to join, and I became involved in the Association's annual meetings and other activities. I was later nominated to the NASB Board of Directors, and I'm currently president of the NASB.



WRMI issues QSL cards with motifs for many of the individual programs that it airs, such as the "Happy Station" with Keith Perron.

The NASB represents the common interests of the private U.S. shortwave stations in dealings with the Federal Communications Commission, and we work together with the FCC at the semi-annual frequency coordination meetings of the HFCC (High Frequency Coordination Conference). The NASB is now a member of the HFCC and we have organized two HFCC conferences – one in Mexico City in 2005 and one in Punta Cana, Dominican Republic in 2009.

The NASB is also a member of the DRM (Digital Radio Mondiale) Consortium, and I served as the chairman of the DRM USA Platform for a few years until I became NASB President, at which time I handed the DRM job over to Adil Mina at Continental Electronics.

Many people ask me how I see the future of shortwave radio. I'm not nearly as pessimistic as those who say that shortwave is dying. Yes, there are all kinds of new technologies such as the Internet, iPods and so on, that compete for our time. But I haven't seen any evidence that the new technologies have replaced shortwave radio; to the contrary, they have complemented it. WRMI has a website with streaming audio, but it's clear that the vast majority of our listeners are still hearing us on shortwave, and the website is a valuable complementary tool, enabling us to provide schedules, programming and other information to our listeners, as well as the live audio stream for those who are not in a location that can receive our shortwave signal.

It's certainly true that many of the government-owned and operated shortwave stations have made drastic cutbacks or disappeared altogether from the shortwave bands since the end of the Cold War and the fall of the Berlin Wall. But, the shortwave bands were extremely crowded, and frankly it's nice to have a bit more space for those of us who still use the medium. One could also make the argument that less "competition" from other stations that are no longer on the air leaves more audience for us.

It's true that the shortwave bands are not the same as they were 20 years ago (who doesn't miss hearing some of those government-sponsored shortwave stations that no longer exist?). But, the bands are still full of interesting stations and programming. Today, governments and large religious organizations are not the only ones who can afford to broadcast on shortwave. Their transmitters have in many cases been privatized and are now selling airtime to small broadcasters at very reasonable prices. Almost any organization can afford $15 or $30 a week for a block of airtime on shortwave to reach listeners in a wide geographical area. If inexpensive DRM receivers can be mass-produced and marketed, DRM could usher in a renaissance for shortwave radio. But in any case, I think shortwave radio still has a future that can be calculated in decades.

WRMI Studio Photo - "Trova Libre" program host Michael Mendez interviews Miami Latin pop singer Maria Lourdes in WRMI's main studio.

Sure, I could have chosen any number of other careers that would have been much more lucrative than shortwave radio. The personal sacrifices for me and my wife Thais, who works with us, have been enormous. But, I honestly can't think of anything that I would enjoy doing more than working in and promoting this medium that brings people around the world together via the airwaves.

The National Association of Shortwave Broadcasters (NASB) web site is **www.shortwave.org**. You can see a current schedule of WRMI programming at WRMI's main web site **www.wrmi.net/broadcast.php**. You may contact Jeff White directly via email: *radiomiami9@cs.com*

SCANNING REPORT

THE WORLD ABOVE 30MHZ

Dan Veeneman
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Oldies but Goodies

If you discovered an old scanner during spring cleaning, you might wonder if it is still useful for something more than a paperweight. The answer is "yes" and there are many areas of the country, often in suburban or rural areas, in which those old scanners can still provide useful service.

❖ Merced County, California

Dan,

In 1997 I bought one of the last AOR 8000 scanners which could still legally have the cell phone frequencies unblocked.

The scanner has sat unused for ten years and now I think it would be fun to listen in on my region's public service agencies, namely local police departments, sheriff's offices, forestry department and the highway patrol.

I live in California's Merced County but I would be interested in listening to public service agencies in Fresno and Stanislaus counties as well.

With all of the changes which have occurred to the radio scanning hobby in the 13 years since I bought this scanner, what good is my AOR 8000 for monitoring my local and area public agencies? Would I be better off buying a new scanner?

Many thanks in advance for your comments and thoughts.

Joe in California

The AOR AR-8000 is a handheld scanner with 1,000 memories and continuous coverage from 500 kHz to 1900 MHz, making it useful for listening to military aircraft, shortwave broadcasts, and commercial AM and FM stations. Users rate it quite highly, noting that it is very sensitive and easy to operate.

Although introduced in 1994, it has a number of "modern" features including a four-line alphanumeric display, a well-documented computer control interface and a "cloning" feature to copy settings from one scanner to another. It can be connected to an Optoelectronics Scout frequency counter to automatically find and tune to nearby transmissions.

As with nearly every scanner, there is an electronic mailing list for the AR-8000. You can find it on the web at **groups.yahoo.com/group/ar8000**. Although the group is not very busy these days, the old messages and files found there can provide useful tips and information.

There have been a lot of innovations in scanner technology since 1994. It doesn't seem like that long ago, but modern scanners are more than just radios – they're now computers with radio capabilities. They have to be, in order to correctly track trunked radio systems and decode digital voice activity. Unfortunately, their thick user manuals and complicated operation often result in a steep learning curve for a new user. Why not stick with an easier-to-use scanner if it meets your needs?

The AR-8000 cannot track any trunked systems and does not have the ability to monitor digital conversations. This limits its usefulness in urban areas where complex trunking systems are employed to efficiently use the available radio spectrum. However, it remains quite capable of scanning conventional (non-trunked) analog radio transmissions, which still serve public safety agencies in less crowded areas of the country.

Fortunately for Joe, the Central Valley is just such an area.

Merced County, California

Merced County is situated between Sacramento and Fresno in the Central Valley of California. It has just over 200,000 residents in an area of about 2,000 square miles. Stanislaus County is to the north and Fresno County to the south.

Merced County dispatches fire calls on 154.400 MHz and uses 154.340 MHz as a secondary. Cities within the county also use VHF frequencies:

Frequency	*Description*
153.815	Los Banos Public Works
154.040	Merced Local Government
154.130	Merced Fire (Secondary)
154.175	Merced Fire (Fireground)
154.310	Los Banos Fire and Emergency Medical Services (Dispatch)
154.815	Los Banos Police (Dispatch)
155.025	Los Banos Local Government
155.520	Merced Police (Secondary)
155.805	Merced Fire (Dispatch)
155.955	Merced Police (Dispatch)

There is some public safety trunked activity in Merced County, specifically a Motorola Type I system that serves county and local law enforcement agencies. The system is licensed for the following frequencies from a repeater site just north of Mt. Bullion: 854.3625, 856.2375, 856.7625, 857.2375, 858.2375, 858.5375, 858.7625 and 859.2375 MHz.

For those of you with trunk-tracking scanners, Motorola Type I systems require the use of something called a "fleetmap" that allows the scanner to properly track. The fleetmap for Merced County looks like this:

B0	B1	B2	B3	B4	B5	B6	B7
S4	S4	S4	S4	S0	S0	S4	S4

If you have a non-trunking scanner like the AR-8000, it's worth using a few of those 1,000 channels to hold each of the listed frequencies. One or two of them will be control channels that produce nothing but annoying digital "hash" sounds and can locked out. The rest of the frequencies will be voice channels, and if the system isn't very busy it's likely that you can catch most conversations just by letting the scanner quickly search them.

It won't be as easy to quickly know who you're actually hearing, since a frequency will be shared among all of the users, but some patience and good detective work will let you figure things out.

The conversations on the trunked system are organized into talkgroups, with a few of them listed here:

Talkgroup	*Description*
000-02	County Medical Transportation ("Medicab")
000-03	County Medical Transportation ("Medicab")
600-09	Dial-A-Ride

600-11	Dial-A-Ride
700-01	County Sheriff (Dispatch)
700-02	County Sheriff
700-03	County Sheriff
700-05	Livingston Police (Dispatch)
700-08	Atwater Police and Fire (Dispatch)
700-09	Dos Palos and Gustine Police (Dispatch)
700-10	County Sheriff

Stanislaus County, California

To the north is Stanislaus County, which is physically smaller than Merced but is home to twice as many people, many of whom work in the San Francisco Bay Area but moved east to find more affordable housing.

Public safety agencies in the county use VHF and UHF as listed in the table below. Note that there are several frequencies assigned on a statewide basis for mutual aid and coordination purposes. Major emergencies and high-profile events can often be heard on these channels across the state.

Frequency	*Description*
151.010	County Fire 3 (Command)
151.115	Sheriff (Interoperability)
151.955	Sheriff Training Center
153.770	County Fire (Dispatch)
153.890	County Fire 3
153.905	Modesto Fire 3
154.190	Turlock Fire
154.265	County Fire (White 2)
154.280	County Fire (White 1)
154.295	County Fire (White 3)
154.325	Oakdale Fire
154.370	Modesto Fire 2
154.415	Modesto Fire 4
154.430	County Fire 2
154.920	California Law Enforcement Mutual Aid Radio System (CLEMARS)
155.085	County Fire 4 (Command)
155.115	County Animal Control
155.370	Sheriff (Dispatch)
155.880	Juvenile Hall
155.910	Downtown Jail
155.940	Modesto Fire 1
156.030	Court Bailiffs
156.075	California On-Scene Emergency Coordination Radio (CALCORD)
158.730	Sheriff (Tactical)
158.865	Sheriff 3 (Secondary)
453.050	County Jail 1
453.325	County Jail 2
453.525	County Fire (Control 1)
453.7625	County Honor Farm
453.950	County Jail 3
462.975	Emergency Medical Services (Dispatch)
463.000	Mednet

Fresno County, California

Fresno County is to the south and has a population of nearly one million. It covers three times the area of Merced County and is one of the nation's most productive agricultural counties.

Fresno County makes heavy use of VHF and UHF analog frequencies for public safety and local government operations.

Frequency	*Description*
151.010	Roads Department
151.085	Roads Department
151.130	Roads Department
152.900	Sheriff (Tactical)
153.140	Public Works
155.160	National Search and Rescue
153.500	Shaver Lake Water Department
153.890	County Fire District 2
153.665	All Agency Interoperability
153.800	Public Works
153.920	Sheriff Area 1 (West, Joaquin Ridge)
154.445	County Fire District 1
154.650	Sheriff Local Law Enforcement Link
154.755	Sheriff Area 2 (Metro, St Agnes)
154.875	Sheriff (Tactical)
154.920	California Law Enforcement Mutual Aid Radio System
154.950	Juvenile Justice Center
155.370	County Jail
155.415	Public Works
155.475	National Law Enforcement Mutual Aid Radio System
155.520	County Jail
155.565	Court Bailiffs
155.580	Sheriff Area 1 (West, Panoche Mountain)
155.655	Sheriff Area 3 (South, Bear Mountain)
156.075	California On-Scene Emergency Coordination Radio (CALCORD)
156.210	Juvenile Justice Center
158.745	County Fire District 3 Tactical
160.545	Sheriff Area 4 (Mountains)
160.590	Sheriff Area 4 (Mountains)
160.695	Sheriff Tactical
460.025	California Law Enforcement Mutual Aid Radio System (CLEMARS)
462.975	Fresno Emergency Medical Services (Tactical)
463.000	Community Regional Medical Center
463.025	Saint Agnes Medical Center
463.050	Community Regional Medical Center
463.075	Community Regional Medical Center
463.100	Children's Hospital of Central California
463.125	CRMC/CHCC/Veteran's Affairs Hospital
453.300	Fresno Emergency Medical Services (Metro)
453.325	Fresno Emergency Medical Services (Rural)
463.625	Fresno Emergency Medical Services (East Side Rural)

❖ Cellular Prohibition

Joe began his letter by mentioning how his AR-8000 is "unblocked," meaning it can scan frequencies allocated to analog cellular telephone frequencies, specifically 824 MHz to 849 MHz (phone to base) and 869 MHz to 894 MHz (base to phone). To someone just getting started with scanning, the prohibition against scanners that can tune to cellular telephone frequencies seems antiquated and ridiculous. It is. Let me give you some background on how we got here.

The Communications Act of 1934, the legislation that established the author-

ity of the Federal Communications Commission (FCC), contained a simple, clear, rational rule on listening to radio signals. Basically, you can listen to whatever you want, but you can't talk about it and you can't use it for personal gain. Under this rule, someone who listens to cellular telephone calls but doesn't divulge or publish what they hear, or use the information for their own benefit or the benefit of someone else, is not in violation of the Communications Act. This was the law when widespread cellular service was introduced in 1983.

This law had worked well for fifty years, but by the late 1980s cellular telephones were beginning to proliferate. The cellular telephone industry was busy telling customers that their conversations were perfectly secure and could not be overheard, but the introduction of affordable scanners capable of tuning in the 800 MHz band proved them wrong.

In 1986 Congress overhauled Title III of the Omnibus Crime Control and Safe Streets Act by passing the Electronic Communications Privacy Act (ECPA), which extended anti-wiretapping provisions to wireless, computer-based, and other electronic communication. It expressly forbid the interception of cellular telephone calls except by authorized law enforcement agencies and telecommunications providers.

Since the Cold War the American public had been told that the Russians, Chinese, North Koreans, and other godless Communists were evil, in part, because they prohibited their citizens from listening to certain radio frequencies. The image of a poor Slav hunkered over an illicit shortwave receiver as jackbooted thugs kicked down his door was held in stark contrast to the expansive freedoms enjoyed by residents of Western democracies. Now in 1986, here in the Land of the Free, Americans were similarly denied the freedom to tune to any frequency they wished.

Certain types of radio energy beaming across your property, into your house and through your body was now off limits, no longer public but owned, controlled, and sold by unaccountable private interests. Under the pretense of "protecting caller privacy," a wealthy and particularly effective lobbying group brought the United States one step closer to the kind of society we proclaimed to abhor. This legislatively-created expectation of privacy, against all logic and physics, whetted Congressional appetites for ever more restrictive laws, further eroding what any "ordinary, law-abiding citizen" could see, hear, and do. This process continues to this day ... but we're getting ahead of the story.

Police states have very high labor costs, and as you can imagine, the FCC and the Department of Justice had much better things to do than go around chasing otherwise law-abiding citizens who happened to be listening to cellular telephone calls. The practical fact that, short of a police state, detection of violators would be nearly impossible, it was clear that the ECPA was a toothless tiger. Even supporters of the cellular portion of ECPA acknowledged that it would be unenforceable, and the Justice Department stated they would not spend any extra money on a listener witch-hunt. Congressman Mike DeWine (R-OH) expressed the feelings of many lawmakers when he commented that if the Justice Department ever spent money on a scanner listener crackdown, "I think we would all question their sanity."

This situation was not acceptable to the Cellular Telephone Industry Association (CTIA), a Washington, DC-based lobbying group for the cellular industry, whose members had been telling their customers for years that their conversations were private and secure. Although a cellular industry lobbyist downplayed ECPA's lack of effectiveness by declaring that it "would discourage an attitude," several instances of interception were publicized and several state bar associations rendered opinions that discussing sensitive issues over cellular telephones could jeopardize attorney-client confidentiality.

The CTIA got their lobbyist money working and in 1991 an amendment was attached to the FCC Reauthorization Act that required the Commission to deny certification to any scanning receiver that could pick up cellular telephone transmissions. When it became clear the Act would not be voted on before the end of the legislative session, the CTIA swung a back room deal and had the anti-scanner provisions moved to the Telephone Disclosure and Dispute Resolution Act (TDDRA), which was ready to be passed. On October 8, 1992, Congress approved TDDRA containing the anti-scanner amendment. The public was not made aware of this until it was too late.

The new law gave the FCC seven months to create regulations that denied certification to scanners that had any overt cellular coverage. On April 19, 1993, the FCC adopted Report and Order 93-201 prohibiting the importation or manufacture of cellular-capable scanners. Frequency converters used with scanners were also prohibited from tuning to cellular frequencies. According to the FCC, scanners that can monitor cellular frequencies "threaten the privacy of cellular telephone customers."

The law and associated regulations remain in effect to this day, despite nearly all cellular telephone traffic having moved to new frequencies and digital voice technology.

❖ Scanner Legalities

Beyond the cellular limitation, there are other areas where scanners and the law cross. Scanners and automobiles, for instance, can create unanticipated problems. In a misguided attempt to reduce crime, some states and municipalities restrict the possession of scanners in vehicles on the presumption that listening to police frequencies demonstrates a nefarious intent. Having a scanner in view during a "routine" traffic stop may elicit suspicious questions from a police officer, even if you are a licensed amateur radio operator and therefore exempt from local restrictions by federal law. A *Monitoring Times* reader offers the following suggestion should you find yourself in such a situation.

Hi,

I discovered a way to answer the police question, "Can your radio receive police frequencies?" in a manner that stops the problem dead.

Rather than answer "Yes", I suggest saying "I'm not sure - what frequency are you on?"

That will give the office pause, as, even if he or she did know, he or she wouldn't want to tell you.

DO NOT answer "yes." Sure, your radio probably can; yes, there is a federal exemption for Amateur Radio operators; and if you want to go to court to prove how smart you are to both the police and the judge, go for it.

I'd rather avoid the problem by saying, "I'm not sure - what frequency are you on?"

I actually told a New York State Trooper, "I don't know – what frequency are you on?" in response to his question, never thinking in terms of it being illegal, or hams having a Federal exemption.

Some time later, I learned of the problem, of the Federal exemption, and remembered that I had accidentally circumvented it by being ignorant and asking a question in response to his question.

So, it's not a theory – I've actually used this response to good results.

Dan via the Internet

That's all for this month. More scanner information, history, links and frequencies can be found on my web site at **www.signalharbor.com**. I also welcome your questions, comments and activity reports via electronic mail to *danveeneman@monitoringtimes.com*. Until next month, happy scanning!

ASK BOB

GENERAL QUESTIONS RELATED TO RADIO

Bob Grove, W8JHD
bobgrove@monitoringtimes.com

Q. *What new frequencies have been added with digital TV? What is meant by channel markings like 9.1, 9.2, etc.? Can radio scanners pick up the new mode? (Ron Blocker, Glenwood, IL)*

A. There are no new frequencies; the same bands (55-88, 174-216, and 470-806 MHz) and channel bandwidths (6 MHz) previously used for analog TV are still authorized, so you can still use the same antenna you used before DTV, but the signal must be strong, otherwise it will drop out (There's no such thing as a "snowy" digital picture!).

Channel 9.1 and 9.2 simply mean that you have a choice between two digital program streams being transmitted on DTV channel 9.

Radio scanners do not have the demodulation capability to reproduce digital TV audio.

Q. *Why do some signals get louder (stronger) when I touch the outer case of my portable radio? (Rene Puente, San Diego, CA)*

A. The conductive salts in your body act as part of the antenna system. The phenomenon is most likely to be observed on radios with whip antennas. At some frequencies your body enlarges the capture area, and may provide both directivity as well as a better impedance match to the radio's antenna-input circuitry. The phenomenon is not likely to be observed on radios with a ground wire on the case or radios with coax-fed antennas, because the additional ground wiring is a far better conductor than you are!

Q. *I am considering purchasing a Wi-Fi radio to listen to on-line scanners from places as listed in Radio Reference. Can I use the radio to access these as well as commercial radio stations? How would I set this type of system up? (Rod Villari, email)*

A. Yes, you certainly can use a simple WiFi radio to hear distant on-line scanners as well as other broadcast services. All you need is an internet connection.

So far as setup, you certainly don't need anything special except the WiFi connection to get any of the scanner or broadcast stations that are streaming their feeds on the net. But if you want local AM/FM broadcasters that aren't on the net, then get a WiFi model that has a built-in AM/FM radio that has either its own antenna, or has terminals to connect to an external antenna.

Q. *I heard that if you drive a couple rods a foot or so into wet soil and apply house current to them, worms will start coming to the surface. Is there any truth to that?*

A. There certainly is; it's an age-old fisherman's trick. More commonly used in the past were the ring generators from old hand-crank telephones. But there's a delicate balance between stimulating worms and electrocuting them! Much depends on the conductivity of the soil.

Q. *I'm trying to hear a distant FM broadcast station on 92.7 MHz, but a local station on 92.5 MHz blocks it. Is there an antenna filter available that would block the offending signal, and can I simply wrap a few turn of wire around my whip to couple an outdoor antenna to it, since there's no external antenna jack? (Clarence Reed, Allen Junction, WV)*

A. Because the offending signal is so close in frequency to the desired signal, an external filter won't work; they aren't sharp enough. Such an attempt will merely decrease the signal level on both frequencies.

If the whip is capable of being swiveled left and right, you might try different angles. You might also try moving the radio to different locations in your home to see if various places will shield the radio from some of the interfering signal strength.

Try placing the radio alongside a large metal surface like a filing cabinet or a refrigerator, or a washer or dryer. Move it around while listening to the desired signal to see if you can get some reflective cancellation of the undesired signal.

One final step (but it's expensive and you might be better off buying a better radio): See if you can null out the offending signal with a rooftop FM antenna turned so that it favors the direction of the desired signal while reducing reception of the local. This would be done only if you can fully compress the whip antenna and couple it to the outside antenna by a turn or two of wire wrapped around it. Try that first by tuning in a weak FM signal that doesn't have interference.

You must use coaxial cable to the antenna and find a grounding spot on the radio's cabinet for the coax shield such as an earphone jack, otherwise the entire cable becomes an antenna and your problem would be worse than before. It would be best to remove the whip and connect the coax and shield internally. But even this won't work if the desired signal is in the general direction of the offending signal.

If you decide to purchase a better radio – and I think that's the real answer – be sure that the supplier will take it back if it suffers the same poor selectivity. If you have Internet, you might consider a WiFi radio for a huge selection of stations.

Q. *While tuning through the shortwave spectrum, I occasionally come across voice transmissions reading lists of numbers. What are these, and are there any books written about them? (MB, Indiana)*

A. No, there aren't any books on this subject, but there's plenty of information on the web and in past issues of *MT* about these spy numbers stations.

Monitoring Times was the first publication to break the story which revealed the locations of US-based stations and their purpose some 20 or more years ago. For the most part they are routine messages broadcast to agents in foreign countries – Cubans in the U.S., Americans in Cuba, etc.

They start with a "header" that addresses a particular agent, then the code is sent which can be decoded only with a one-time pad, a pack of pages which changes every day to thwart deciphering by code breakers.

At the time we covered the story, the strong Spanish-language signals were from an old, WWII German-made (as I recall), broadcast transmitter, and originated from just outside of Havana. The English-language transmissions came from a U.S. Army communications installation in Remington, Virginia near the Warrenton Training Center.

Questions or tips sent to Ask Bob, c/o MT are printed in this column as space permits. Mail your questions along with a self-addressed stamped envelope in care of MT, or e-mail to bobgrove@monitoringtimes.com. (Please include your name and address.)

UTILITY WORLD

HF COMMUNICATIONS

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The Strange Weirdness on 13420 and Other Stories

It was never my intention to cover "numbers" three months in a row. But then, two altogether new or nearly new players appeared. Even more intriguing, both are extremely bizarre. How could I resist? Therefore, let's get to it.

First Vietnamese Numbers

I don't believe there's ever been a numbers station broadcasting in Vietnamese, even during the war. This changed on Sunday, February 21, when Lief Dehio and a US listener who goes by "Original Token" co-discovered a female voice giving coded messages in upper-sideband voice (USB). The frequency was 10255 kilohertz (kHz), and the time was around 1600 Coordinated Universal Time (UTC).

This just seemed like another short wave oddity, until the station came back the next Sunday, same time and frequency, with a male voice. A couple of weeks after that, a more or less daily schedule began. It continues at press time.

The callsign, source, and purpose of this station has still not been determined. It is definitely structured like the numbers transmissions we're used to. While most of these have been pretty well proven to be aimed at spies operating in deep cover abroad, there's still some discussion regarding whether this new one is a shipping or fishery company sending coded messages to personnel on its vessels afloat.

Until this is resolved, there's no ENIGMA 2000 designator. ENIGMA 2000, as we know, is the online incarnation of the European Numbers Information Gathering and Monitoring Association which is in charge of such things. They're very knowledgeable on this subject.

Here's what we do know: The broadcasts continue, nearly daily, on 10255 kHz USB. They start around 1600 UTC. Precise timing of the start is irregular and can come anywhere between 1557 and 1604.

Right now, two live male voices are being heard. I can receive this station with a good, clear signal every morning, local time, and I can easily tell that it's being read by a real person, not digitally assembled from smaller pieces. Cadence varies only a little, indicating good attention to procedure, but it does vary. In addition, the numbers don't look identical on spectrum plots, the way the Cuban ones do. These variations are too great to be simple ionospheric distortion.

An individual broadcast lasts about 6 minutes. It is repeated, but not on any kind of a consistent schedule. Sometimes there are two or three repetitions right together. Other times there are one or two, spaced out over an hour or so. Sometimes, though, there's no repeat at all.

Transmissions also seem to be repeated on subsequent days. Once again, though, there's no consistency for these. However, the repetitions suggest that broadcasts are recorded, not read straight onto the air.

Interestingly, various noises peculiar to the Microsoft Windows operating system are frequently heard. Especially common is that bonk sound that's made when the volume is adjusted. These seem to get out over most numbers stations from time to time, but a lot more on this one. Therefore, it's fairly certain that a computer is being used for the recording and playback.

Let's look at a typical transmission. It begins with a Vietnamese phrase which features the words "hai dang." This translates into the English "lighthouse." It may or may not be significant that Viet Nam is a coastal nation, with around 80 lighthouses.

So what we have is a phrase containing the word "lighthouse," repeated twice, and that group repeated five times. Next come several announcements and numeric preambles.

After these come another announcement, content unknown, repeated three times. Then we go into a message in either 60 or 71 five-number groups, with no repetitions. This is the obvious payload of the transmission.

For those who like to transcribe such things, here are the number digits in Vietamese: 1 = mot (sounds like "boat"); 2 = hai; 3 = ba; 4 = bon; 5 = nam (sounds like "num"); 6 = sau; 7 = bay (sounds like "buy"); 8 = tam; 9 = chin.

Finally, all this ends with four to five repetitions of the original "lighthouse" phrase.

We definitely need a fluent speaker of Vietnamese to help sort all this out. Meanwhile, I have sent a recording to *MT* for inclusion on the audio section of its web site.

French Version of "Russian Man"

The other "new" station might actually be an old one that has come back after a decade. Numbers stations have a way of doing this.

Ary Boender, who publishes the *Numbers and Oddities* Newsletter, suggests that is a very rare Russian transmission in French, ENIGMA designator V23. It was heard only once, for a week in 1999.

Whether or not it's new, it certainly got itself noticed on March 17, when European numbers listeners happened upon it. It was heard running with a continuous loop on 13420 kHz, in standard amplitude modulation (AM). This started at some unknown time before the first discovery at 0742 UTC, and ran until 1004. At this point it dropped to dead carrier, and finally vanished.

As of press time, it hasn't been heard again, but everyone's still talking about it. There are several reasons for this.

The first, of course, is its easy identification as coming from Russian intelligence. The agency responsible is probably the latest alphabet-soup successor to the old Soviet KGB. This infamous agency dissolved soon after the USSR, but its communication and intelligence functions have continued under a series of new organizations.

In the past, this operation has shown a tendency to keep popping up in new languages and slightly different "male" or "female" machine voices. Old-style logging by names like "Russian Man," "English Lady," and the sort became so confusing that it provided the hobby an impetus to switch to ENIGMA's classification in the first place. This has really sorted a lot of things out for us.

Another reason is the sheer weirdness of the March 17 transmission. Mike T, a longtime contributor from West Sussex, UK, even made a YouTube video, in which he graphically explains all the strange things happening here while you look at the very nice collection of equipment receiving it.

This video is at **www.youtube.com/watch?v=f4mxx87FNXs**. It contains the strangest part of this bizarre broadcast and documents one of the best numbers catches in years.

What you start off hearing, as Mike points

out in his subtitles, is the French computer voice callup. For no reason that we can discern, it suddenly switches to the same thing in German, using a format known as G06. Then it abruptly goes to Spanish (V07), and back to French.

In all three cases, the numeric preamble stays the same, and only the language changes. It's almost as if someone's sitting at a computer clicking off options because he can't believe they really want it in French, at which point the boss makes it clear that they really, really do. And so they restart.

After this restart, you hear a standard Russian intelligence preamble, namely 683 27 0910. What you also hear is The Whales (ENIGMA XW).

The presence of "whales" on this signal is extremely interesting. This is a spooky, moaning noise, which usually appears by itself. It's associated with heavily line-conditioned or amplitude-companded voice circuits used by military relay stations. In the past, most of these have been US military, but there's no reason they have to be. Early on, the sound reminded someone of those humpback whale recordings. The name stuck.

No one has ever come up with a convincing explanation for what causes "whales." The noises usually vanish any time someone uses the link for traffic. At this point, presumably, the wide-open receiver reduces gain. After the traffic stops, the gain slowly increases again, and the whales come back.

It would be a little strange, therefore, to have this noise on a busy transmitter. Was it getting in through some other frequency, or just co-channel interference in this busy band segment? We do not know.

The French voice has a distinctive accent. People have suggested that whoever they used for the voice is possibly a native speaker of Russian or some African language.

Now, one might be thinking that the only thing between all this and complete numbers weirdness overload would be the Microsoft Windows noises mentioned on the Vietnamese station. Well, guess what? It had those, too. The Windows bong noise was heard three times right before the station dropped carrier. Wrong button?

Mike's video stops when the station does, but people listening on-frequency for any other activity weren't disappointed. Another recording has an obviously sampled female voice saying something that sounded like "Ciao," at irregular intervals.

This is all just too strange. 13420 kHz is definitely a frequency which will need considerable watching.

❖ Final HF FAX Corrections

Many of our readers might remember the lengthy list of HF (high frequency) FAX (radiofacsimile) broadcasts in the December column. At the time, I asked for additions, deletions, and corrections. Quite a few people responded, precipitating some good discussions. The general improvement in band conditions also answered some questions.

Unfortunately, there's no room to run the whole list again. What we can do is to pass along all the corrections, so that our readers can make the appropriate changes.

In the case of Russia, everyone says they think some of the faxes are still on the air, but no one can find any specific station identifiers. Some of this uncertainty might be seasonal, since some stations operate only in summer, or only in the ice season. Meanwhile, the safe assumption is that most or all of the listed Russian broadcasts have become irregular of left the air altogether. Perhaps time will tell.

One remaining Russian schedule that Europeans routinely log is a mysterious military weather chart on 5103 and 7090 kHz. It is headed "GM-11F." There have also been possible Russian faxes in the past year on 4067 and 8443 kHz. On these and all other FAX frequencies, remember that your radio dial will read 1.9 kHz lower when it is properly tuned.

We also have a lot of changes for Japan. Everything is still on the air, and then some, but it has moved around.

It is now safe to assume that JJC, the former Kyodo News feed from Tokyo, is no more. This identifier is no longer being used. Most likely, the transmitters were forced to move when the large HF site north of Tokyo closed down. This also affected the Tokyo aviation weather ("Volmet"), and the marine weather FAX (JMH).

We know that one of these former JJC frequencies, namely 16971.0 kHz, now identifies as JSC. It almost certainly comes from Kagoshima Prefectural Fishery Radio, a large and growing site at the southern end of Japan. This frequency is stronger in the western US than all the others, and it's copyable more hours of the day.

Otherwise, the rest use the same identification, all in Japanese, as the one that was used by Kyodo's other station in the Singapore or Penang area. It's a safe bet that everything's coming from Kagoshima or Singapore at this point.

In the case of the Japanese fishery itself, we've been able to confirm that JFC, Misaki, JFX, Kagoshima, and JFW, Fukushima, are all broadcasting a full schedule of faxes on the common frequencies of 6414.5, 8658.0, 16907.5, and 22559.0 kHz. All these are prefectural level stations. If there ever was a central fishery ("chuo gyogyo") station, there almost certainly isn't one now.

We have one more piece of information about the Japanese fishery. Several contributors to this column have gotten excellent verifications of reports by e-mail ("eQSL") from these stations. Typically these contain engineering data and photos of the really nice setups that the fishery is using. The prefectural fishery radio is a large, well-funded activity, so check around the Internet for the proper e-mail addresses.

Moving along, it is now known that the Thailand fax is still active, but only on 7395 kHz. This has been verified by listening, both here and by several correspondents. Mainland China, meanwhile, can't be verified. It's probably best to assume it's gone until someone proves otherwise. Taiwan, however, is active and monitored daily.

Several other stations are almost certainly inactive. Unless something changes, we should delete 5YE, Nairobi; 6VU, Senegal; IMB, Rome; L2B, Argentina; OXT, Denmark; and everything from Antarctica.

The result of all this gives us a much shorter list than all the others published on the Internet, but also a far more accurate one. Even the lists maintained by reputable government agencies have been shown to be a couple of steps behind.

Don't get depressed by all this. HF FAX is not going away any time soon, and we still have plenty of nice strong stations to copy. Once this column has been out for a while, and more information is available, I'll post the final list revision to the web site and blog. Then we'll have finally achieved the goal of updating the old Marius Rensen HF FAX list that most of the hobby is still using.

Stay enlightened, and see you next month.

ABBREVIATIONS USED IN THIS COLUMN

AFB	Air Force Base
ALE	Automatic Link Establishment
AM	Amplitude Modulation
CAMSLANT	Communications Area Master Station, Atlantic
CAMSPAC	Communications Area Master Station, Pacific
CAP	US Civil Air Patrol
COTHEN	Customs Over-The-Horizon Enforcement Network
CW	On-off keyed "Continuous Wave" Morse telegraphy
DEA	US Drug Enforcement Administration
DHFCS	UK Defence High Frequency Communications Service
DSC	Digital Selective Calling
E06	English male computer voice, 5-figure groups
EAM	Emergency Action Message
FAX	Radiofacsimile
FEMA	US Federal Emergency Management Agency
FSK	Frequency-Shift Keying
HFDL	High-Frequency Data Link
HF-GCS	High-Frequency Global Communication System
LSB	Lower Sideband
MARS	US Military Auxiliary Radio System
MFA	Ministry of Foreign Affairs
MX	Generic for Russian single-letter beacons/ markers
NASA	US National Aeronautics and Space Administration
NAT	North Atlantic oceanic control, families A-F
OPBAT	DEA Operations, Bahamas and Tortugas
PR	Puerto Rico
R3E	Single sideband, reduced carrier
RTTY	Radio Teletype
S06	Russian male computer voice, 5-figure groups
SECURE	State Emergency Capability Using Radio Effectively
Selcal	Selective Calling
SESEF	Shipboard Electronics Systems Evaluation Facility
SITOR-A/B	Simplex Telex Over Radio, mode A or B
UK	United Kingdom
Unid	Unidentified
US	United States
USS	United States Ship
USAF	US Air Force
USCG	US Coast Guard
VHF	Very High Frequency, 30-300 MHz
Volmet	Scheduled aviation "Flying Weather" broadcast

All transmissions are USB (upper sideband) unless otherwise indicated. All frequencies are in kHz (kilohertz) and all times are UTC (Coordinated Universal Time). "Numbers" stations have their ENIGMA (European Numbers Information Gathering and Monitoring Association) designators in ().

3256.0 "P"-Russian single-letter CW channel marker (MX), Kaliningrad, also on 3291, 3327, 3699.5, and 3837, at 2213 (Ary Boender-Netherlands).
3314.0 Unid-Russian Air Defense, target tracking with formatted CW time-stamped datagrams, similar on 5139.5 and 6321.5; at 2234 (MPJ-UK).
3331.0 CHU-Canadian National Research Council, Ottawa, standard time signals at 2251 (MPJ-UK).
3658.0 "V"-Russian CW marker (MX), Khiva, also on 4149.5, at 1836 (Boender-Netherlands).
3828.9 "The Squeaky Wheel"-Russian military marker, odd noises at 2150 (Boender-Netherlands).
4073.0 Unid-Russian military CW time strings, 4 hours ahead of UTC, at 1840 (Boender-Netherlands).
4239.5 XSS-UK DHFCS control, Forest Moor, working XKD, net also uses 4706, 6691, 6873.5, 10344.5, 10575, 12230, 14455, and 14485.5; ALE at 2355 (MPJ-UK).
4325.9 "R"-Russian CW military marker (MX), Izhevsk, at 2158 (Boender-Netherlands).
4331.0 4XZ-Israeli Navy, CW message in 5-letter groups, at 0027 (MDMonitor-MD).
4385.0 R22967-US Army or National Guard helicopter, working ground station SANJAN, ALE at 2339 (Metcalfe-KY).
4490.0 T69ME1-US military, possibly Army, also on 9106, 10493, 10816.5, 11608.5, 13568, 14653, and 16338; ALE sounding at 2050 (MDMonitor-MD).
4515.0 "5-Z-O"-US military, 28-character EAM at 0053, 20-character EAM at 0055, and 6-character EAMs at 0055 and 0056 (Jeff Haverlah-TX).
4604.0 Down East 201-CAP, ME, checking into net at 2333 (MDMonitor-MD).
4625.0 "The Buzzer"-Russian AM military marker, intermittent buzz at 2150 (Boender-Netherlands).
4724.0 Undulate-US military, 28-character EAM and "standing by for traffic," then working an unknown aircraft, at 0106 (Haverlah-TX).
4812.0 GS53-Algerian military, calling GS40, also on 5065, 5085, 5180, 5875, 7935, 11125, 14354.6, and 14387.6; ALE at 1942 (PPA-Netherlands).
5000.5 OFF-USAF, Offutt AFB, NE, working B99, possible US Army, also on 8000.5 and 12000.5, ALE at 1658 (Jack Metcalfe-KY).
5097.0 CFH-Canadian Forces, Halifax, NS, RTTY marker mentioning frequencies of 2822, 3394, 4167, 6260, 8324, 12371, and 16552; at 2015 (PPA-Netherlands).
5100.0 VMC-Australian Bureau of Meteorology, Charleville, FAX chart listing VMW (Wiluna) frequencies, at 1707 (PPA-Netherlands).
5123.0 AAA-Israeli Air Force control, Tel Aviv, working DD2; also using 6504, 6533, 6621, 6736, 6748, 6925, 7961, 9219, and 16730; ALE at 1718 (PPA-Netherlands).
5127.0 "The Russian Man"-Russian intelligence (S06), AM null-message format repeating "349 349 349 00000," at 1900 (PPA-Netherlands).
5133.5 MROWISKO02-Polish military. ALE and Polish voice with LIBERA72 and BIWAK27, also on 5187.5, 6873, and 12183.8; at 1846 (PPA-Netherlands).
5140.0 D01IDOT-District 3, Illinois Department of Transportation, working IL5, possible state EOC, also on 5135, 7932, and 7935; ALE at 2126 (Metcalfe-KY).
5153.7 "D"-Russian Navy CW cluster beacon (MX), Sevastopol, also on 8494.7 (MPJ), 13527.7, 16331.7, and 20047.7; at 2150 (Boender-Netherlands).
5153.8 "P"-MX, Kaliningrad, also on 7038.8, 13527.8, and 16331.8 (MPJ); CW at 2150 (Boender-Netherlands).
5153.9 "S"-MX, Arkhangelsk, also on 7038.9, 10871.9, and 18331.9 (MPJ); CW at 1842 (Boender-Netherlands).
5154.0 "C"-MX, Moscow, also on 7039, 8495 (MPJ), and 13528; CW at 1842 (Boender-Netherlands).
5186.0 "The English Man"-Russian intelligence (E06), AM callup 891 392 15 and message, at 2030 (PPA-Netherlands).
5197.0 E06, callup 634 995 15 and message, R3E at 2130 (PPA-Netherlands).
5260.0 OK1IF-Czech Republic amateur CW experimental station, working G3XXR, UK, and back to beacon mode, at 1958 (MPJ-UK).
5574.0 San Francisco-Pacific oceanic air control, position from Delta 1170, then handed flight to Los Angeles Center VHF 132.15, at 0236 (Prez-MD).
5616.0 Gander-NAT-B, Canada, clearing Delta 8821 to 40,000 feet at 0220 (Prez-MD).
5622.0 9V-SKD-Singapore Airlines A-380, HFDL log-on with Krasnoyarsk, at 2019 (MPJ-UK).
5649.0 Gander Radio-NAT-D, selcal check with a Speedbird (British Airways) flight, at 0433 (Allan Stern-FL).
6496.0 CFH-Canadian Forces, Halifax, NS, FAX wave chart for Maritimes at 2018 (Prez-MD).
6535.0 Dakar-African air route control, position from Speedbird 246, handed flight to Dakar VHF 120.50, at 0150 (Prez-MD).
6586.0 New York Radio, selcal check AS-CQ and routing with Canforce 3249, a converted A310 with tail number 15001, at 0202. New York, selcal DH-CQ to Skytour 5065, a Skyservice Airlines B757, registration C-FFAN, at 0233 (Stern-FL).
6646.0 Unid-Two sailors discussing their work, usual salty language, mentioned Virginia Beach, at 1901 (Prez-MD).
6673.0 San Francisco-Pacific oceanic air control, position from Alaska Airlines 859, sent flight to 11282 kHz, at 0206 (Prez-MD).
6676.0 Unid-Male voices chattering in Arabic, apparent informal net, at 0300 (Prez-MD). [Volmet freq; bad choice. -Hugh]
6712.0 Andrews-USAF, Andrews AFB, MD, 28-character EAM at 1739 (Boender-Netherlands).
6834.0 E63-Unknown, asking group call NET1 for link check, answered by E60, K1R, K5R, and K8R; ALE at 1030 (ALF-Germany).
6836.0 5WI-Unknown UK military, asking "any station, this net" for radio check, no joy, at 0827 (ALF-Germany).
6970.0 Unid-Unknown military, "prova radio" ("radio test") and test count in Italian, then "fine prova," at 1011 (ALF-Germany).
6973.0 RIT-Russian Navy Northern Fleet, Severomorsk, CW traffic for RLO, at 1008 (ALF-Germany).
7477.0 R05IDPH-Possible IL department of public health, voice and ALE checks with EX2, also on 5135, 5140, 5192, and 7935; at 2101 (Metcalfe-KY).
7527.0 PAC-USCG CAMSPAC Point Reyes, CA, ALE and voice with J16, USCG MH-60J helicopter Coast Guard 6016, at 2041 (MDMonitor-MD).
7535.0 Charm-US Navy Amphibious Assault Ship USS Wasp, testing with Norfolk SESEF, VA, at 2003 (Metcalfe-KY).
8040.0 GYA-UK Royal Navy, Northwood, FAX surface analysis at 0000 (Prez-MD).
8140.0 BMF-Taiwan Meteo, Republic of China, FAX chart of Malaya and Borneo, at 1933 (MPJ-UK).
8419.0 WLO-Mobile Radio/Shipcom, AL, Morse identifier in SITOR-A marker, also on 8421, at 0014 (MPJ-UK).
8912.0 PR1PRI-US Customs COTHEN remote, PR, also on 10242, 11494, and 12222, ALE at 1640 (MDMonitor-MD).
8918.0 New York Radio, air traffic control with USAF B-52H Skull 40, at 1914 (Stern-FL).
8942.0 G-VGAS-Virgin Atlantic A340 "Vargas Girl," flight VS0007, HFDL log-on to Shannon, at 1427 (MPJ-UK).
8977.0 B-KPH-Cathay Pacific flight CX0841, a B777, HFDL log-on at 2040 (MPJ-UK).
8983.0 CAMSLANT-USCG, VA, calling Coast Guard 2128, an HU-25D Falcon Jet, no joy, at 1532 (MDMonitor-MD).
8992.0 Andrews-USAF HF-GCS control, MD, 28-character EAM at 1551 (MPJ-UK).
9025.0 ADW-USAF, Andrews AFB, MD, ALE-initiated patch from J22, then Coast Guard 6022 discussing a search with Miami Ops, at 1422 and 1440 (MDMonitor-MD).
10057.0 San Francisco-Pacific oceanic air control, sent unknown flight to 5547 kHz, at 0100 (Prez-MD).
10087.0 014-HFDL ground station, Krasnoyarsk, Russia, uplink to D-ALCD, a Lufthansa Cargo MD-11F, at 1318 (PPA-Netherlands).
10223.7 Unid-Egyptian MFA, Cairo, selcalling IPTX (Havana, Cuba), then SITOR-A traffic at 2050 (PPA-Netherlands).
10242.0 LNT-USCG CAMSLANT, ALE with J03, then voice working Coast Guard 6003, an MH-60J, at 1849 (MDMonitor-MD).
10255.0 Unid-"Lighthouse" station, male voice with numbers in Vietnamese, at 1600 (Boender-Netherlands).
10536.0 CFH-Canadian Forces, Halifax, NS, FAX weather chart, then into RTTY weather at 2022 (MPJ-UK).
10871.6 "D"-Probable Russian Navy, CW single-letter marker at 2320 (Metcalfe-KY). [Has also been reported as "U;" FSK Morse? -Hugh]
10872.2 "F"-MX cluster beacon, Vladivostok, CW at 1544 (PPA-Netherlands).
11000.0 RIW-Russian Navy, Moscow, CW message to group callsign RKZ, at 1626 (MPJ-UK).
11217.0 Lonesome-US military, patch to Cotter Pin via Offutt AFB, NE, came from 11175, at 1552 (Metcalfe-KY).
11300.0 Air Madagascar 054-Flight calling Khartoum, no joy, finally passed position to Tripoli, Libya, at 0006 (Prez-MD).
11354.0 009-HFDL ground station, Barrow, AK, squitters and logging in unknown aircraft at 1802 (PPA-Netherlands).
12222.0 Panther-OPBAT, Nassau, Bahamas, working Juliet 40, USCG MH-60J Coast Guard 6040, at 1747 (MDMonitor-MD).
12577.0 005030001-Charleville/Wiluna Radio, Australia, DSC call to 356507000, Panama registry vessel Gas Eastern, at 1520 (PPA-Netherlands).
12579.0 NMF-USCG, Boston, MA, gale warnings in SITOR-B, at 1653 (PPA-Netherlands).
12695.5 UWS3-Kiev Radio, Ukraine, CW navigation warnings at 1241 (PPA-Netherlands).
12745.5 Unid-Kyodo News, Japan, FAX newspaper (60/576), in Japanese at 1728 (PPA-Netherlands).
13321.1 008-HFDL ground station, Johannesburg, South Africa, uplink to ZS-SND, a South African Airways A340, at 1747 (PPA-Netherlands).
13330.0 Kenya Airways-Company Long-Distance Operational Control, Nairobi, taking weather observations from flight Kenya 320, at 1921 (PPA-Netherlands).
13528.1 "A"-MX, possibly Astrakhan or Baku, also on 16332.1, 17332.1 (MPJ), and 20048.1; CW at 1046 (Boender-Netherlands).
13927.0 Ruff 07-US Navy E-6 TACAMO (TAke Charge And Move Out), patch via USAF MARS AFA5YD, OH, to McConnell AFB, KS, regarding refueling, at 0055 (Stern-FL).
14445.7 71-Egyptian MFA, Cairo, SITOR-A message for London, at 1042 (PPA-Netherlands).
14455.0 KHA 908-NASA Ames Research Center, CA, weekly NASA net with KHA945, AL, and KHA 959, VA, at 1635 (Metcalfe-KY).
14923.7 Unid-Egyptian diplomatic, selcalling Cairo in SITOR-A, then passing traffic with a 16-tone modem, at 1508 (PPA-Netherlands).
14959.0 OM1-US military, radio checks with OM2 and OM3, at 2006 (Metcalfe-KY).
15016.0 Andrews-USAF HF-GCS, passing 3 EAMs at 2032 (PPA-Netherlands).
15034.0 Trenton Military-Canadian Forces Volmet, aviation weather at 1540 (PPA-Netherlands).
15602.0 060PCRCAP-US Civil Air Patrol, Pacific Coast Region, also on 17412, ALE sounding at 1600 (MDMonitor-MD).
15867.0 501-USCG HC-130H Coast Guard 1501, calling LNT, ALE at 1858 (MDMonitor-MD).
15920.0 CFH-Canadian Forces, Halifax, NS, RTTY marker at 1106 (MPJ-UK).
16240.0 20111-Moroccan Civil Defense, calling 2412, ALE at 1714 (PPA-Netherlands).
17430.0 Unid-Kyodo News, Singapore/ Penang, noisy FAX fishery charts at 1830 (Hugh Stegman-CA).
17435.0 20111-Moroccan Civil Defense, working 2214. ALE at 1407 (MPJ-UK).
18594.0 K66-USCG Coast Guard 6566, an HH-65C helicopter, ALE sound at 1419 (MDMonitor-MD).
22559.6 JFC-Misaki Prefectural Fishery Radio, Japan, "JFC-FAX" chart with numbers in columns, weak parallel on 16907.5, at 0030 (Stegman-CA).

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Your First RTTY Station

❖ Your First RTTY Station

I would like to thank the many readers who wrote in over the past couple of months and made suggestions concerning the kinds of columns they would like to see. I'm particularly happy to oblige one of the first suggestions, sent in by Brian Chapel. Brian's suggestion was a walkthrough of decoding "your first digital utility signal" using free software, and perhaps expanding this idea by progressing to more complex modes in the future.

What better place to start than standard Baudot RTTY? Get your skates on, though, because as regular readers will know, these stations are fast disappearing from the HF airwaves!

❖ Shortwave Radio

Nothing too fancy is required in terms of the radio you use, but it must be as stable and drift-free as possible. You can use something cheap and cheerful as long as it has Single Side Band (SSB) capability. Good examples of new radios at around the $100 mark would be the Grundig/Eton (G6), Sangean (ATS505) or Kaito (1103). We've done this at home with an old Grundig Yacht Boy 400. Your radio doesn't even need to be digital, either, as long as you know what frequency you are tuned to reliably!

Fine tuning is also helpful. By this, we mean 100Hz steps, but even 1kHz should work without problems. Some radios with larger steps have a "Clarifier" knob. This is used to fine tune a signal after arriving roughly at the right frequency.

A Line Out (fixed level) audio output connection is also most useful. This means that the radio supplies a constant level of audio to your decoder software regardless of how you set the audio (AF) gain. It also allows you supply this audio at the same time as being able to listen via the speaker or headphones.

If you don't have a Line Out, don't despair, as you can use the headphone socket, but remember that you need to be able to hear the audio, too! In this case, you can roughly tune the signal, plug the audio in, and then use the decoder's features to adjust for the correct center frequency if required. Luckily, some decoders adjust themselves to tune the signal in.

If you don't have Line Out, remember to start the audio low and increase slowly if you aren't getting any copy.

❖ Software

For this exercise, we'll use TrueTTY as our decoder. TrueTTY is a great little decoder for beginners using Windows and supports CW, RTTY, PSK31, SITOR-A and B, and a number of other modes. So, if you find success with this walkthrough, you can try your hand with these other signals, that aren't any different in terms of the technique required.

TrueTTY can be used without limitation, but if you like what see and it works for you, please consider registering the software for $39. This helps the dedicated authors of these programs provide you with good support and allows them to make improvements over time.

If you are on a Mac, you can use the free Cocoa Modem or MultiMode, which are very similar in operation to TrueTTY. The Fldigi software works across many platforms, including Linux, and is also well-respected by digital monitors.

❖ Computer and Radio Connection

All of the software we have selected works in the same way and uses your computer's soundcard to process the audio signal from the radio, turn it into a bitstream, and then decode the digital data according to the parameters you set.

All you need to do is locate your computer's Line In (or Microphone In) jack and hook-up a connection between this and the Line Out or Headphone socket of your radio. This usually requires little more than a simple screened speaker or microphone cable with the appropriate connectors installed at each end. If you don't want to make one, you can pick one up at any electronics store.

If your computer doesn't have a microphone input or Line In, but does have a USB socket spare, you can use a neat trick and convert your radio's audio into USB data. The Griffin iMic is a good example. For $30, this little gem allows you to plug your radio's audio into its "mic" or "line in" sockets. At the other end of the iMic is a USB plug that goes into your computer. *Voila*, instant line-level audio!

❖ Best Stations

There are a few RTTY stations that continue to provide good coverage from Europe to the US and beyond. Depending on local conditions and the time of day, try listening for the strongest and cleanest signal (that means free from interference or close-by strong signals) from any of the following:

CFH Canadian Force
Halifax Canada
4271, 5097, 10536, 10945, 13510 kHz

DDK/DDH German Weather Service
Pinneberg, Germany
4583, 7646, 10100.8, 11039, 14467.3, 15988 kHz

Both of these stations have 24hour schedules and spend their time sending clear text, so it's easy to tell if your decoder is working properly.

So, before we start, tune your radio to these frequencies and see which works channel best for you.

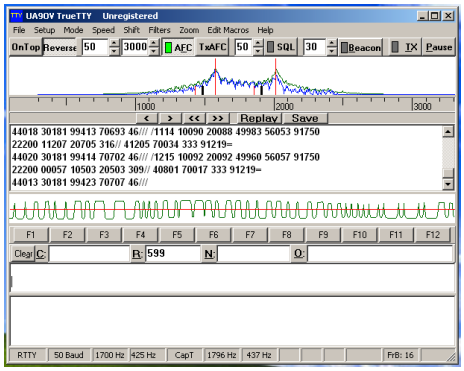
❖ Basic Operation

The basic operating principles are the same regardless of the software used:

- Tune into your signal of choice
- Set the speed (baud) and tone shift (Hz)
- Tell the decoder whether the station sends data Normal or Reverse (denotes whether the upper or lower of the two tones is the binary "1")

And that's just about all that's required! Here's an example using TrueTTY:

1. Tune the radio to 2kHz below the listed frequency above (USB)
2. You should hear the rhythmic burble of Pinneberg
3. Start TrueTTY
4. If all is well, you should see a picture like Figure 1; if not, check audio levels and connections



5. From the Speed menu, select 50bd
6. From the Shift menu, select 425Hz
7. Click the "Normal" button (which should change to "Reverse")

You should be seeing text like that below

If you are listening to Halifax, set the decoder for 75bd, 850Hz and Reverse in steps 5 to 7 respectively. Halifax also "rests" often and sends just one tone. Wait until you hear the rhythmic burble of traffic before you start the decoder to ensure the best "lock" on the signal.

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ON THE HAM BANDS

THE FUNDAMENTALS OF AMATEUR RADIO

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June is a Great Ham Radio Month

Well, if you know me by now, you probably have figured out that I think every month of the year is a great ham radio month. If you think about it for a few minutes, there really aren't all that many hobby activities that lend themselves to year round 24/7 participation. Hams can turn their rigs on any time and find some other ham type folks to enjoy the radio hobby with. Oh, you may have to pick and choose your band under given conditions, but that is all part of the fun as well.

I am just lifting up June this… well… June, because it has some great operating activities that hams young and old can get involved in. June is a great month to work Special Event Stations, a great way to collect some very unique and memorable QSL cards. You might also hear many folks operating portable from campsites and other vacation locations.

There are three major operating activities in June that I will discuss below.

ARRL JUNE VHF QSO PARTY
JUNE 12 - 14

Contesting above 50 MHz has always been somewhat different from Low Band HF contesting. Station set-up can take several forms. Any combination of power, height above ground, feedline, and antenna gain can change the ability of a station to operate competitively. If you can only pump out 10 watts, but have 30 elements at 100 feet fed with hardline, you are going to have an advantage over a guy running 100 watts into 4 elements at 30 feet fed with regular coax.

With more multiband transceivers, including 6 meters and even 144 and 432 MHz SSB, the ability for anyone to enjoy playing in a VHF contest increases. What I enjoy about VHF contesting is that, even with a highly competitive station (and mine is far from being that), most of the activity is relatively local. You will be swapping calls with a lot of folks from your immediate region, often folks you might even know. That gives VHF contesting a more relaxed pace. You can chat a bit after exchanging reports. Just the ticket for a hot summer night.

Summer weather patterns can make for interesting tropospheric propagation as well, sometimes making it possible to hear things that would be a bit hard otherwise. Folks have no trouble taking a few extra rounds to make a legal contact.

The scheduling of this contest also catches the edge of the Lyrids Meteor Shower (June 14-16), making this unique form of weak signal contact possible even for a humble station.

If you like adventure, consider operating mobile as a "Rover." You can take your mobile station up a hillside, giving you that whole "height above ground" advantage, or you can locate in a rare grid square, making your contact all the more desirable to other folks playing the game.

I usually operate 144 and 432 MHz CW and SSB in the Low Power category. I put up a passable score, given that I am only using omnidirectional loops at about 40 feet fed with Belden 8813 coax. I still make a lot of contacts, talk to a lot of friends and have a lot of fun. I won't win any trophies, but I get to enjoy ham radio. That is the only prize I care about.

For more information on the June operating activity Web on over to: **www.arrl.org/contests/rules/2010/jan-vhf-ss.html**

KIDS DAY
SATURDAY, JUNE 19 1800-2400 UTC

Hosted by the ARRL in cooperation with the Boring Amateur Radio Club, Kids Day is held twice a year, usually in January and June. The expressed purpose is to get young people (licensed or not) on the air and talking to one another. It is a way for established hams to show younger folks that they can have a heck of a lot of fun if they just step away from their computer games and televisions for a few minutes.

This is a great opportunity for individual hams to introduce younger members of their family or younger neighbors to the hobby, but I think it really shines as a club activity as well. If you have a club station or a central location where you can set up an HF and/or VHF station, you can put out press releases to your local schools and hang signs in your libraries. You will not only get the word out to young people, but may be able to garner a little press coverage for your local club's efforts.

Here's another idea: Kids Day occurs the weekend before ARRL Field Day (more on that event later). A Kid's Day station set-up would be a great way to shake down your equipment for the upcoming FD event.

The event rules are fairly simple. Get your station up and running from1800 through 2400 UTC on 19 June. Find some kids (rather important). Have one of the youngsters (under the direction of an appropriately licensed ham) call "CQ Kids Day." Once they receive a return call, have the young person exchange name, age, QTH and favorite color with the child on the other end. Each new kid counts as a new contact, so if you have a couple of kids and the ham on the other end has a few, you may be running quite a list.

Suggested frequencies include 28.350 to 28.400 MHz, 24.960 to 24.980 MHz, 21.360 to 21.400 MHz, 18.140 to 18.145 MHz, 14.270 to 14.300 MHz, 7.270 to 7.290 MHz, 3.740 to 3.940 MHz, as well as your local 2-meter repeaters (with permission of the repeaters' control operators). Do not forget to observe third-party restrictions should you find yourself in a DX QSO. (Yes, kids from all around the world participate in this event.)

This is a fun, relatively non-competitive event, so feel free to allow the kids to chew the rag a bit. Log submissions are welcome and can be sent to the Boring Amateur Radio Club, PO Box 1357, Boring, OR 97009.

A colorful Certificate of Participation is available for download by filling out the Kid's Day Survey at **www.arrl.org/FandES/ead/kids-day-survey.html** Folks without internet access can send an SASE to the same address as listed above for log submissions.

FIELD DAY
JUNE 26-27, 2010

Field Day is always the fourth full weekend of June, beginning at 1800 UTC Saturday and ending at 2100 UTC Sunday. Field Day 2010 will be held June 26-27, 2010.

I always think of this as ham radio's weekend in the woods, but it is so much more than that. It is an opportunity to demonstrate your individual or group's ability to set up and operate a radio communications system under conditions quite similar to emergency operations. Throughout the years, many hams have come up with ingenious ways of making this happen, including alternative power systems, unique antenna designs, and creative logistical systems to provide food and shelter for the operating team. The rules get tweaked a bit from year to year, so it is always wise to download the ARRL Field Day Packet at: **www.arrl.org/contests/forms/fd-2010-packet.pdf**

In addition to demonstrating how well hams work in tough times, the ARRL encourages making your Field Day operation open to the public as a way of promoting how ham radio continues its excellent history of helping their communities in times of trouble. A further review of the rules

will show that extra points are earned for Media Publicity and for locating in a public area and setting up a public information table. More points are awarded if your station is visited by government or public service officials. You can even grab 100 points by offering an educational activity on site.

Bonus points are also awarded for 100% emergency power, alternative power and low RF power. Folks have used everything from solar to steam to satisfy this category.

You can get points for copying specific bulletins and message handling.

Points are also awarded for Youth Participation, so maybe you'll want to invite some of those Kid's Day participants out to your Field Day site.

If you are in an amateur radio club, no doubt folks have been talking up Field Day for a couple of months now. If you are not a member of a club, you can still get in on the fun. The ARRL has a Field Day Locator application on their Web Site at: **www.arrl.org/contests/announcements/fd/locator.php**

You can also participate in a solo Field Day effort if you like. Class B through Class E operations can all be run by a single operator. I like to operate Class B - Battery, Low Power. The XYL and I just purchased a new camper and I am thinking that a little trip out into the Pine Barrens of New Jersey is warranted come Field Day weekend. I can run my Elecraft K2 Solar Battery Power with a few dipoles strung up in the trees. I'll be listening for you!

❖ Become a Professional Amateur

I mentioned a few issues back that my amateur radio credentials opened quite a few doors for me in the employment world over the years. Another credential that has helped me remain gainfully employed has been the FCC General Radiotelephone Operators License (GROL). Put simply, the GROL is the license by which you demonstrate your basic understanding of electronics, radio rules and regulations to the commercial radio world. It is the gateway credential to a whole world of possibilities for a career in radio electronics.

Now allow me to let you in on a great little secret. If you have worked your way through the amateur radio license structure up through the Extra Class test, I am fairly sure you will find the GROL exams no more difficult that the Extra tests. The exam structure and even many of the questions are similar to those you encounter on the amateur tests. The exam process is also similar, utilizing a network of examiners and an FCC approved question pool. All you need is a good source to get you through the test. Allow me to suggest one of the best:

FCC COMMERCIAL RADIO LICENSE PREPARATION STUDY MANUAL
GROL + RADAR
By Gordon West WB6NOA
With Pete Trotter KB9SMG and Eric Nicols KL7AJ
ISBN# 978-0-945053-60-6
320 pages $49.95
Published by Master Publishing Inc.
6019 W. Howard St., Niles, IL
www.masterpublishing.com 847-763-0916

You may have already used some of Gordon West's W5YI Group resources to help you get your amateur radio license. Gordon WB6NOA's ham training tools are known throughout the hobby. His commercial training manual is on par with all of his ham radio resources. His GROL + Radar book will guide you through the process of Elements 1, 3 & 8 of the FCC Commercial License structure.

Element 1 is Radio Law. Passing this element gives you a Maritime Radio operators Permit. Element 3 is the technical portion of the commercial license, and adding that to your successful completion of Element 1 gives you the GROL. Passing these two elements puts you on the road to many opportunities in the radio world, but, like they say on all those late night TV commercials: "But wait… There's more!" If you really want to cover all the bases commercially, you will want to also study and sit for Element 8. This element puts you in a position to work on air, land and marine Radar systems.

Gordon's study guide covers the history of radio up through modern times, explaining how many of the rules and regulations that govern radio operation came into being. He also covers various commercial career opportunities such as radio installer or cruise ship radio operator, along with information on any additional study that may be required to move along in your chosen field. The guide also covers everything you need to know about modern safety systems such as the Global Maritime Distress and Safety System (GMRDSS) and Emergency Position Indicating Radio Beacons (EPIRB) system.

The heart of this, as in any study guide, is its comprehensive Question Pools. Better than many resources, Gordon doesn't just show you the proper answers, he explains the reasoning, theory or regulations that apply. You don't just learn to pass the test, you learn about relevant radio concepts.

The book includes a CD containing all relevant portions of the F.C.C. Title 47 Telecommunication Rules. West's book includes the current list of Commercial Operator License Examination Manager's (COLEM) sites, where you will be taking your test. Think of a COLEM as a commercial version of the amateur radio Volunteer Examiner (VE).

Now, let me remind you that obtaining the GROL is just the start of your journey into a future career in commercial radio communications; however, it is a necessary step and one well worth taking.

❖ A Shameless Plug

Many of you know that, years ago, I authored a book called *Radio Monitoring – A How To Guide*. Originally published by Index Publishing Group and later released by Paladin Press, it's had two very successful editions that sold for many years. This book has recently gone out of print, but I am pleased to say that I have now released it on line (for FREE) via Creative Commons license. I admit that a few points are a bit dated, but the book still has a lot to offer the beginner or even experienced radio hobbyist.

You can download a copy, thanks to the North American Shortwave Association (NASWA) who have consented to be the primary online source for distribution. The direct link is **www.naswa.net/areybook.html**. The hobby has been good to me over the years. I am happy to give this book back to the radio community. Enjoy.

Have fun! I'll see you on the bottom end of the forty meter band.

GETTING STARTED

THE BEGINNER'S CORNER

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Beginner's Guide to Field Day

Field Day is an amateur radio holiday, sponsored by the American Radio Relay League (ARRL) that has all the aspects of Christmas, the Fourth of July, and Halloween. The sense of expectation, excitement, festive atmosphere, oppressive heat, and nasty surprises descend on the amateur radio community for the last whole weekend in June and that, in a nutshell, is Field Day.

❖ Field Day Rules

Field Day dates back to 1933 and was one of the first nationwide emergency communications drills. The premise is that, without commercial power or access to elaborate base antenna systems, hams should be able to contact anyone, anywhere, at anytime. Given normal band conditions that's no doubt true, but what makes Field Day tricky is that (and here's where the Halloween aspects come in) band conditions are usually poor; it's the middle of thunderstorm season, and nearly every licensed ham in the U.S. is on the air at the same time.

You only thought you knew what a crowded band was like: Wait until you key up on 20 meter phone in the middle of the first day! I've actually worked two stations simultaneously, signals are that close together.

Field Day is structured as a contest, with detailed rules about how many points each contact that's made can count for your club or individual entry, according to a rating scheme that takes into account power output, type of electricity source used, number of participants (special points for beginners!), the presence of public officials, and on and on. While some clubs shoot for top scores in their category, most hams are in it for the camaraderie, fun and endless stream of junk food.

Each person likes to do Field Day their own way. Some like to join in with their local club, which often involves elaborate set-up assignments, complicated operating schedules and the involvement of much of the local non-ham community. The exercise is, after all, also a public relations event that endeavors to show the public that, given enough time, money and hot dogs, a club can have a lot of fun generating an amazing number of contacts with other hams over a two day period. Operations are usually held under a big tent or some other temporary shelter that can keep operators and equipment dry.

At the time this was written, 2010 ARRL Field Day rules had not been posted, but as we get near the date (June 26-27), check in at League HQ (**www.arrl.org**) and print out the rules. You don't have to submit a log of your contacts, but you should at least submit your comments, some might make it into the ARRL Field Day blog or QST Field Day wrap-up months later.

Solar power is great for Field Day, it helps show alternative energy as you demonstrate emergency communications. This system from PowerEnz delivers 120 watts at 10 amps ($830) and might be a good investment for an individual or a local ham club that can be used year 'round. (Courtesy: PowerEnz. www.powerenz.com; 770-639-2244)

❖ Reality Strikes

For many years, due to family and work commitments, I was unable to operate on Field Day. But, about 10 years ago that changed and I've been doing my own Field Day event ever since. Typically, I work only a few hours during each of the two days, with the personal goal of working all 50 states during the event. That may seem like an easy task, since every state has thousands of operators on all bands at all times. But, that's just the problem, every state has thousands of operators on at all times. And, being on the East Coast it's always easy to work the smaller states (Rhode Island, Delaware, Washington, D.C., etc.) but it's tough to work the sparsely populated western states (Idaho, Wyoming, North Dakota) and the really tough ones: Alaska and Hawaii. It's the opposite for hams on the West coast. My personal best is 42 states.

Since I always operate Field Day QRP (under 10 watts voice and under 5 watts CW or digital modes), it's an even bigger challenge to work all states. Still, that's most of the fun. And, since I also use only an improvised antenna, it's even trickier to wedge my signal into the pile-ups. On top of all that I also operate solar generated battery power and that makes it the Trifecta for impossible working conditions. You can see how this makes it tougher and tougher.

So, why operate like that? Well, because it most closely duplicates real emergency conditions. I remember a number of years back when the remnants of Hurricane Isabel tore through the Mid-Atlantic states, and more than 10 million people were without power and telephone service for three days to two weeks. Thanks to my Field Day experience, I was able to pull a battery out of one of the vehicles, hook it up to the rig and call out. In short order I contacted hams with phone patch capabilities and far-flung family members were told that everything here was fine. This was particularly important since cell towers were down and even the local 2 meter repeaters were so low on power, hams were asked not to use them unless it was a 911-style emergency.

❖ DIY Field Day

If you're doing Field Day with a local club, sign up and wait for assignments. You'll be busy the whole weekend. Most club stations operate around the clock in shifts. With solar activity the way it's been the last few years, that means most of the nighttime activity is on 160 through 40 meters. (The WARC bands, 30, 17 and 12

meters, are traditionally off-limits to all contests including Field Day.) Daytime operations will take place on all bands. Depending on your skills, you'll be asked to stand shifts on voice, CW or digital modes. Some club stations have every conceivable operating position covered for maximum point gain.

But, if you're doing it yourself, you can do as much or little as you like. Depending on weather conditions (I don't like operating in the rain), I work Field Day until it gets dark, then I pack it all up and wait until Sunday morning to finish. There's a few hours left to fill in the missing states and pack up for good. Usually I work SSB voice, but this year I hope to do digital modes and, thanks to reading Keith Baker's amateur radio satellite column, I'm hoping to make some contacts through the satellites as well.

If you plan to do Field Day by yourself here are some tips taken from my own experiences:

- Make your station (transceiver, portable antenna, power supply, snacks and drinks) fit in a container (cooler or box with handles) you can easily carry by yourself.
- If you're setting up at home or in a public area (make sure you can do so without a special permit), set up your station in the shade of an obliging tree, it doesn't take long to get a memorable sunburn.
- Use a comfortable, but portable chair and table and pay attention to where you place them. Look for ant beds, wasp nests, etc. At the slightest sign of a thunderstorm, pack it all in and hunker down safely indoors. Bring a scanner along or a 2 meter HT with NOAA WX reception capability to keep an eye on afternoon thunderstorms that might crop up in a hurry. It's good to know about them in advance.
- Bring plenty of water and pack lunches, snacks and anything else you'd like to munch on for hours at a time. Take plenty of breaks to enjoy the scenery or chat with passersby. When operating at dusk or after dark use a bug repellant with plenty of DEET content or you will get eaten alive.
- Have a friend or relative help with antenna installation. Don't take chances. Stay off ladders and don't climb trees. Use inventive methods of stringing antennas in trees. I once enlisted the aid of a high school pitcher who could accurately throw a baseball with a string attached high up into the trees.
- After you're set up, test your station on one of the WARC bands where all the Field Day refugees have sequestered themselves. Anyone on these bands will be happy to have an old-fashioned rag chew and let you know how your signal sounds.

The ubiquitous G5RV antenna from MFJ Enterprises meets all the qualifications for a good Field Day antenna: It stores in a small place, it's easy to put up, covers 80 through 10 meters and, at $45 from Universal Radio, it's cheap! (Courtesy: Universal Radio)

❖ Field Day Strategies

There are a number of strategies to consider when you start. One is to set up on a particular frequency and start calling "CQ Field Day." The other is to troll the bands looking for people calling "CQ Field Day." In both cases the rules specify how long you can stay on any one band. This forces everyone to move around. But, if you're operating low power, you're better off trolling than staking out a frequency.

Today's modern transceivers lend themselves well to Field Day activities. They're small, lightweight, all-band, all-mode and most have built-in antenna tuners. That means just about any kind of antenna configuration will work. I've used everything from a random length dipole (cut for the random length between two randomly chosen trees), to random lengths of magnet wire strung haphazardly from tree to tree at whatever height I could toss it. You'll be amazed at what works!

Many hams build special all-band Field Day antennas designed to put up and pack up with ease. There's no limit to what you can use. If you're not comfortable building your own antenna, the MFJ G5RV all-band antenna sold through Universal Radio for $45 is a perfect, ready-made, cheap, Field Day antenna (**www.universal-radio.com**; 800-431-3939).

Most club stations use gas-fired generators to run several stations at once. Some individuals do as well. I always use the battery out of my lawn tractor and a small solar cell to trickle charge the battery when I'm not operating. This set up, at low power outputs, works for the duration of the event. But, there are other power sources to consider. There are a number of solar-powered generators that would be nice to have year round.

Log your contacts with a logging program, if you're used to doing so. If not, use a legal-sized pad of paper to record all your contacts. Later you can sort out the duplicates, errors and fill in your regular log. It's fun to look back over the years to see how you did. I also include comments such as weather conditions and what equipment I used. For instance, in 2007 it was a beautiful day: 80º, partly cloudy with unusually low humidity.

For more fun, invite a couple of ham friends over to join in Field Day activities. Or use this opportunity to introduce family members or neighbors to the hobby. Even in this day of cell phone communications, I've always found that people are amazed at the fact that I'm sitting outside chatting with people from all over the U.S. on a battery-powered radio hooked up to a wire in two trees. Everyone understands the emergency communications implication.

The Icom 706MKIIG is typical of today's full-featured transceivers capable of running low power or high power on 160 through 70 cm bands, and it's easy to pack, making it a great Field Day rig in addition to going mobile or as your base station. (Courtesy: Universal Radio)

One thing to remember about Field Day is that it's fun. Considering that hundreds of thousands of hams across the U.S. and from around the world are participating, it's good to hear the ham spirit exhibited by most. It's also good to hear beginners on the band, whether adult or child, as Field Day makes room for everyone. And, this year try something new. Work a different mode: digital, CW or satellite. Let me know what you did this year for Field Day and I'll pass it along to the rest of the *MT* readers.

PROGRAMMING SPOTLIGHT

WHAT'S ON WHEN AND WHERE?

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International Coverage of Polish Tragedy

This month we shine the *Programming Spotlight* on coverage of the tragic events that took place in April near Smolensk, Russia and take a brief look at the National Association of Shortwave Broadcasters, which met in Canada in May.

On April 10, 2010, tragedy struck Poland and Eastern Europe when a plane carrying Polish President Lech Kaczynski, his wife, and a large delegation of military, government and religious officials, crashed in Russia on the way to a ceremony marking the 70th anniversary of the Katyn Massacre. Katyn was the location of the executions of thousands of Polish POWs by the Soviet NKVD in 1940. The event has been an open sore in Russo-Polish relations for seven decades. The ceremony was meant as a gesture towards reconciliation.

I decided to follow live coverage of this tragic event from the originating source wherever possible. I downloaded and listened to all available English broadcasts from Polish Radio External Service, via the World Radio Network (**www.wrn.org**).

All regular programming was suspended and instead, news updates and reports were interspersed with somber music. PRES did a magnificent job of covering this breaking news shortly after it happened, and its continuing coverage was excellent and comprehensive. Except for an aside during the 1400 UTC broadcast on April 10, the idea of a Russian conspiracy never once came up. That in itself was remarkable and demonstrates how times have changed.

John Beauchamp of the PRES English Service was interviewed on Canadian television the day of the accident. He indicated that the entire staff of the English section had either been called in or reported for work on their own initiative.

Later in the day I listened to the Polish language service for several hours, which of course discussed the crash, played mostly somber, funereal music, and at one point appeared to carry live coverage of a Catholic Mass. (This service, presumably from Warsaw, may have gone out over several networks of Polish Radio.)

In subsequent days, I listened to many hours of Jedynka, Polish Radio 1 broadcasts. During Polish nighttime broadcasts, one could hear some of the most stunningly beautiful music, hymns, Church music, and classical pieces. Even without understanding much of the dialogue, aside from the odd words or phrases similar to those in English or Russian, it was not hard to feel the national sadness experienced in Poland.

Kaczynski was not the most popular President. In fact, he was expected to lose in elections against the Speaker of Parliament, who ironically, by the rules of the constitution, has become acting President until elections can be held in June. Nevertheless, domestic politics were swept aside in the wake of the tragedy in a rather remarkable way.

Regional neighbors were slow off the mark in their coverage, perhaps giving evidence that the news departments of the various English Services close down for the weekend. News of the tragedy did not make it to the English broadcasts and websites until UTC Monday. English newscasts for Radio Slovakia International, Radio Ukraine International, Radio Romania International and Radio Bulgaria all neglected the news until Monday. All stations were focused on Easter (the week before) or the nuclear summit in Washington.

I listened for several hours Sunday evening to the webcast of Radio Ukraine International. Interestingly, English newscasts were obviously recorded on Thursday or Friday. However, Ukrainian language newscasts led with the story. Perhaps it's just that no one works on the weekend in the English Service. Kudos to Radio Prague who led with the story all weekend, as did Voice of Russia World Service.

Voice of Russia's coverage of the crash, and the investigation of it, has been extensive. It was quite a contrast to the Chernobyl disaster of 1986, which was not admitted for days by what was then Radio Moscow.

It will be interesting to follow the broadcasts of Polish Radio External Service, the Voice of Russia, and others in the region in the coming weeks and months, to see what effect the events of April 10, 2010 have on Poland, on Russo-Polish relations, and Europe in general.

In our time, when events happen, tragic or otherwise, we have so many more options, including local and international radio, via internet and shortwave, which allow us to follow events closely as they happen.

The National Association of Shortwave Broadcasters

It had been my intention to look at the NASB in last month's column. At the end of May, the NASB held its annual meeting in Hamilton, Ontario. This month we'll look briefly at the radio stations of the NASB. Future columns will look at selected stations in more detail.

In 1978 when I began listening to shortwave, there were a limited number of private sector shortwave stations, principally WYFR and the rarely heard KGEI and WINB. No licenses had been granted for years, until Joe Costello broke the logjam in 1982 with his WRNO. I still have a special QSL certificate for a reception report I made back in 1982 as WRNO first went on the air.

In those early years, WRNO was a very special station, featuring music (The Rock of New Orleans) through the week and a variety of religious and paid programs on the weekend. And, for a time, it played host to one of my all time favorite programming blocks, Jeff White's Radio Earth. WRNO's calliope interval signal was the precursor to a dramatic increase in private sector shortwave broadcasting in the United States.

Once WRNO hit the airwaves, many other stations followed over the course of the 1980s, some lasting longer than others. WHRI (World Harvest Radio) in Noblesville, IN, was started by Lester Sumrall. Another of my favorites was WCSN, a broadcasting arm of the Christian Science Monitor. KVOH arrived with something of a splash, broadcasting out of Simi Valley, CA. If I recall correctly, they all came online around 1984 or 1985.

Other stations debuting at this time included KNLS in Anchor Point, Alaska, KUSW in Salt Lake City, KCBI in Dallas and WMLK in Pennsylvania.

In the late '80s and early '90s, a number of powerful new stations appeared on the bands, including Mother Angelica's WEWN, broadcasting from Birmingham, Alabama and WWCR from Nashville, TN. These two continue to be among the most easily heard stations on the shortwave bands. I became a regular listener of WWCR or World Wide Christian Radio at this time. Its eclectic schedule of programs was always interesting.

I had never really heard Dr Gene Scott before he suddenly appeared on my radio one day via WWCR. I spent a lot of hours listening to the good Dr and to this day I still haven't really figured him out. The "patriot" shows were always amusing as well -- that is, they were until April 20, 1995 when the Federal Building in Oklahoma City was bombed. However, beyond the wing nuts there was always some good music programming such as Rock the Universe, The Old Record Shop or Worldwide Country Radio.

Jeff White's Radio Miami International (WRMI) and WTJC/WBOH also joined the fold. (*See this month's 'First Person Radio' for a profile of Jeff White-ed.*)

It's impossible to describe the output of all of these stations in a few paragraphs. Some of them

broadcast around the clock on multiple frequencies. Having said that, there is a wide variety of programming, something for every taste. If audibility is an issue, many of them are available on the internet as well.

Many of these stations are "Christian" stations and if you give them a listen you will find that there are a significant number of different interpretations of the Bible and Christian teachings. Tune around the dial and you will hear everything from the Catholic teachings of Mother Angelica on WEWN, to Harold Camping's worldview on WYFR, services across the spectrum from Orthodoxy to Fundamentalism, daily Bible teachings and fiery evangelists. I have always found this mosaic of radio programs fascinating.

WRMI, Radio Miami International is popular with everyone except the Cuban government, it seems. I often listen via the internet to the variety of programs in English and Spanish. On WRMI you can hear anti-Castro "clandestines," DX programs like *DX Party Line, Wavescan* and *World of Radio*, Keith Perron's *Happy Station Show*, and *Viva Miami*. Not to mention programming from the World Radio Network and other international broadcasters.

Allen Graham HCJB, Thais and Jeff White WRMI

WWCR, World Wide Christian Radio has something for every listener. Country, Country Gospel and Contemporary Christian music can be heard throughout the day. For many years *Rock the Universe* was a must-hear program in my household. (There have been no new programs of *Rock the Universe* for some time while host Rich Adcock deals with some health issues. His website indicates that the show may return in the fall. I wish "The Viceroy of Vinyl" all the best, with a speedy return to the airwaves!) It is also home to such programs as *The Golden Age of Radio, Ask WWCR*, and the *Electronic DX Press*.

Recommended Listening

Radio Exterior de Espana – Rock in Spain the name suggests, the program highlights a rock band or artist from Spain. It's a window onto the pop music scene in Spain that I quite like. It is heard on UTC Wednesdays (and some UTC Fridays). I love programs like this (**Hits in Germany – DW** is another), which give one an opportunity to hear music that might otherwise "fly under the radar."

The most recent edition, as this is written in early April, looked at a band called Mago de Oz (Wizard of Oz). The hosts sound like they are younger than average, but well informed about the bands and the Spanish music scene in general. Try the 0000 UTC broadcast on 6055 kHz or listen online.

You can now get the daily English broadcast from Spain as a podcast. You can listen online or download your own copy via iTunes or the program of your choice. **www.rtve.es/podcast/radio-exterior/emision-en-ingles/**

What's New

BBC World Service – Witness – I'm not sure if this is a new program or just one I failed to notice in the past. Since BBC WS abandoned North America via shortwave I have kind of given up on it. When one can listen to *ALL* BBC networks or even local broadcasters online, why settle for a happy meal when you can patronize the all-you-can-eat buffet?

As the name implies, *Witness* is a program dedicated to "the story of our times told by the people who were there." The most recent episodes looked at such diverse topics as the Adolph Eichmann trial in Jerusalem in 1961, the famous first interracial kiss on US television in 1968 (Captain Kirk really did boldly go where no one had gone before), the Patty Hearst case, the Unabomber and the Rwanda genocide.

Witness airs every weekday on the World Service. In addition the program is archived for 7 days from the time of broadcast and is also available as a podcast (my preferred method), downloadable using your preferred podcatching software (I use iTunes).

It's very interesting to get first-hand accounts of events by people who were there. It would be even better if the BBC had a permanent archive of all episodes. But for now, I'll build my own, and hope this program has a long life!

You can find the program at **www.bbc.co.uk/worldservice/programmes/2009/10/000000_witness.shtml** or go to the World Service homepage and scroll to the bottom.

An observation about the Voice of Russia website. In these warmer days of summer, the Voice of Russia seems harder than ever to hear on shortwave. In local evenings, one can try 9665 or 9890 kHz, or listen via the website at **www.ruvr.ru**

Most VoR programs have their own web page and often have a link to audio for the program (although not in all cases). Perhaps it's a sign of the times, but for many news stories, rather than an audio link, there is a link to video coverage of the story, from RT (Russia Today) Television. Call me old school, but I would rather hear VoR audio, but, then again, kudos to VoR for trying to make their website more appealing/useful to the 21st Century listener/viewer.

I must say I did appreciate a recent report on the KHL (Kontinental Hockey League) Semi-Finals. As a possessor of the Canadian hockey gene, it was fun to see a montage of the best plays between MVD and AK Bars (whoever they are). Perhaps it's only a matter of time before someone in Russia does a remake of the song about Eddie Shack, star pugilist of the Toronto Maple Leafs in the 1960s. Although, "Clear the Track, Here Comes Yaroslavl Lokamotiv" doesn't have quite the ring of "Here Comes Shack" **www.youtube.com/watch?v=QqvNfez5zBA**

Speaking of hockey…Yes, there will probably be hockey in June again this year. The Stanley Cup Finals represent that rare occasion when hockey might actually be covered by the **BBC**, **VoA's *Sonny Side of Sports*** and others. Years ago AFRTS would carry the odd match. In those pre-internet days AFRTS was often the only way to hear a sports broadcast from a distant city. I listened to the odd Toronto Raptors game (NBA) and many baseball games, giving me the opportunity to hear local broadcasters from distant cities.

I haven't seen AFRTS reported in ages, but apparently they are on 12,133.5 kHz, 7812.5 kHz and 5,446.5 kHz Upper Side Band out of Key West, FL. Anybody still hearing this? Let me know. It's a long way from when AFRTS used the powerful VoA transmitters for most of the day.

Finally, back to Russia real quick. I heard an edition of the venerable ***Moscow Mailbag*** in early April, hosted by Olga Troshina and Max Gorbachev. Other than triggering the thought, "Hmm, Gorbachev…I wonder if he's any relation to Mikhail?" I found Max to be a very good host of the program. He's no Joe Adamov, but then who is? If he is going to be the regular co-host, then the program is in good hands for years to come.

Olga and Max stickhandled around a question about Russia's performance at the Winter Olympics with all the finesse of an Alexander Ovechkin (one of the top hockey players in the world)!

How to Use the Shortwave Guide

Convert your time to UTC.

Broadcast time on ① and time off ② are expressed in Coordinated Universal Time (UTC) – the time at the 0 meridian near Greenwich, England. To translate your local time into UTC, first convert your local time to 24-hour format, then add (during Standard Time) 5, 6, 7 or 8 hours for Eastern, Central, Mountain or Pacific Times, respectively. Eastern, Central, and Pacific Times are already converted to UTC for you at the top of each hour.

Note that all *dates*, as well as times, are in UTC; for example, a show which might air at 0030 UTC *Sunday* will be heard on *Saturday* evening in America (in other words, 7:30 pm Eastern, 6:30 pm Central, etc.).

Find the station you want to hear.

Look at the page which corresponds to the time you will be listening. English broadcasts are listed by UTC time on ① , then alphabetically by country ③, followed by the station name ④. (If the station name is the same as the country, we don't repeat it, e.g., "Vanuatu, Radio" [Vanuatu].)

If a broadcast is not *daily*, the days of broadcast ⑤ will appear in the column following the time of broadcast, using the following codes:

Codes	
s/Sun	Sunday
m/Mon	Monday
t	Tuesday
w	Wednesday
h	Thursday
f	Friday
a/Sat	Saturday
occ:	occasional
DRM:	Digital Radio Mondiale
irreg	Irregular broadcasts
vl	Various languages
USB:	Upper Sideband

Choose the most promising frequencies for the time, location and conditions.

The frequencies ⑥ follow to the right of the station listing; all frequencies are listed in kilohertz (kHz). Not all listed stations will be heard from your location and virtually none of them will be heard all the time on all frequencies.

Shortwave broadcast stations change some of their frequencies at least twice a year, in April and October, to adapt to seasonal conditions. But they can also change in response to short-term conditions, interference, equipment problems, etc. Our frequency manager coordinates published station schedules with confirmations and reports from her monitoring team and *MT* readers to make the Shortwave Guide up-to-date as of one week before print deadline.

To help you find the most promising signal for your location, immediately following each frequency we've included information on the target area ⑦ of the broadcast. Signals beamed toward your area will generally be easier to hear than those beamed elsewhere, even though the latter will often still be audible.

Target Areas
- af: Africa
- al: alternate frequency (occasional use only)
- am: The Americas
- as: Asia
- ca: Central America
- do: domestic broadcast
- eu: Europe
- me: Middle East
- na: North America
- pa: Pacific
- sa: South America
- va: various

Mode used by all stations in this guide is AM unless otherwise indicated.

MT MONITORING TEAM

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Additional Contributors to This Month's Shortwave Guide:

Thank You to …

BCL News; *DX Asia*; British DX Club; Cumbre DX; DSWCI-*DX Window*, Hard-Core DX; Radio Bulgaria *DX Mix News*; Media Broadcast, Play DX; WWDXC-BC DX-*Top News*; World DX Club/*Contact*, PTSW; World Radio TV Handbook.

Alokesh Gupta, New Delhi, India; Arnulf Piontek, Germany; Dragan Lekic; Elena Osipova, VO Russia; Ivo Ivanov; Bulgaria; Mike Barraclough, UK; Jaisakthivel, India; Sean Gilbert, UK; Sei-ichi Hasegawa, Japan; Leo van der Woude/R Netherlands; Noel Green, UK; Rachel Baughn/MT; Ron Howard, CA; Rich D' Angelo/NASWA-*Flash Sheet*, NASWA-*Journal*; Tom Taylor, UK; Wolfgang Büeschel, Germany.

Shortwave Broadcast Bands

kHz	Meters
2300-2495	120 meters (Note 1)
3200-3400	90 meters (Note 1)
3900-3950	75 meters (Regional band, used for broadcasting in Asia only)
3950-4000	75 meters (Regional band, used for broadcasting in Asia and Europe)
4750-4995	60 meters (Note 1)
5005-5060	60 meters (Note 1)
5730-5900	49 meter NIB (Note 2)
5900-5950	49 meter WARC-92 band (Note 3)
5950-6200	49 meters
6200-6295	49 meter NIB (Note 2)
6890-6990	41 meter NIB (Note 2)
7100-7300	41 meters (Regional band, not allocated for broadcasting in the western hemisphere) (Note 4)
7300-7350	41 meter WARC-92 band (Note 3)
7350-7600	41 meter NIB (Note 2)
9250-9400	31 meter NIB (Note 2)
9400-9500	31 meter WARC-92 band (Note 3)
9500-9900	31 meters
11500-11600	25 meter NIB (Note 2)
11600-11650	25 meter WARC-92 band (Note 3)
11650-12050	25 meters
12050-12100	25 meter WARC-92 band (Note 3)
12100-12600	25 meter NIB (Note 2)
13570-13600	22 meter WARC-92 band (Note 3)
13600-13800	22 meters
13800-13870	22 meter WARC-92 band (Note 3)
15030-15100	19 meter NIB (Note 2)
15100-15600	19 meters
15600-15800	19 meter WARC-92 band (Note 3)
17480-17550	17 meter WARC-92 band (Note 3)
17550-17900	17 meters
18900-19020	15 meter WARC-92 band (Note 3)
21450-21850	13 meters
25670-26100	11 meters

Notes

Note 1 Tropical bands, 120/90/60 meters are for broadcast use only in designated tropical areas of the world.

Note 2 Broadcasters can use this frequency range on a (NIB) non-interference basis only.

Note 3 WARC-92 bands are allocated officially for use by HF broadcasting stations in 2007

Note 4 WRC-03 update. After March 29, 2009, the spectrum from 7100-7200 kHz will no longer be available for broadcast purposes and will be turned over to amateur radio operations worldwide

0000 UTC - 8PM EDT / 7PM CDT / 5PM PDT

0000	0004		Canada, Radio Canada International			6100na
0000	0015	mtwhf	Moldova, (Transnistria) Radio PMR			9665na
0000	0027		Czech Republic, Radio Prague			9790na
0000	0030		Egypt, Radio Cairo		11590na	
0000	0030		Thailand, Radio Thailand World Service			15275na
0000	0030		USA, Voice of America		7555as	
0000	0045		India, All India Radio		6055as	7305as
			9705as	11645as	13605as	
0000	0056		Romania, Radio Romania International			7335na
			9580na			
0000	0057		Canada, Radio Canada International			11700as
0000	0057		China, China Radio International			6005na
			6020na	6180na	7350as	7425as
			9425as	9570as	11650as	11885as
			11730as	11790as		
0000	0100		Anguilla, Worldwide Univ Network			6090am
0000	0100		Australia, ABC NT Alice Springs			4835do
0000	0100		Australia, ABC NT Katherine		5025do	
0000	0100		Australia, ABC NT Tennant Creek			4910do
0000	0100		Australia, Radio Australia		9660as	12080pa
			13690pa	15240pa	17715pa	17750as
			17665as	17795pa		
0000	0100		Bahrain, Radio Bahrain		6010me	9745al
0000	0100		Canada, CFRX Toronto ON		6070na	
0000	0100		Canada, CFVP Calgary AB		6030na	
0000	0100		Canada, CKZN St John's NF		6160na	
0000	0100		Canada, CKZU Vancouver BC		6160na	
0000	0100		Germany, Deutsche Welle		9885as	15595as
			17525as			
0000	0100		Malaysia, RTM/Traxx FM		7295do	
0000	0100		New Zealand, Radio NZ International			15730pa
0000	0100	DRM	New Zealand, Radio NZ International			15720pa
0000	0100		Russia, Voice of Russia		9665na	9890na
0000	0100		Spain, Radio Exterior de Espana			6055na
0000	0100		UK, BBC World Service		5970as	6195as
			7395as	9740as	12095as	13725as
0000	0100		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0000	0100		USA, EWTN/WEWN Vandiver AL			11520af
0000	0100	Sat	USA, WBCQ Monticello ME		7415am	
0000	0100	sm	USA, WBCQ Monticello ME		5110am	
0000	0100	m	USA, WHRI Cypress Creek SC			7315am
0000	0100		USA, WINB Red Lion PA		9265ca	
0000	0100		USA, WJHR International Milton FL			15550usb
0000	0100		USA, WRMI Miami FL		9955ca	
0000	0100		USA, WTJC Newport NC		9370na	
0000	0100		USA, WTWW Lebanon TN		9480na	
0000	0100		USA, WWCR Nashville TN		4840na	7465na
			9980na			
0000	0100		USA, WWRB Manchester TN		3185na	3215na
			6890am			
0000	0100		USA, WYFR/Family Radio Worldwide			5950na
			6985na	7520ca	9505na	15440na
0000	0100		Zambia, 1 Africa Radio/CVC		4965af	
0005	0100	twhfa	Canada, Radio Canada International			6100na
0030	0045	twhfas	Albania, Radio Tirana		9860na	
0030	0100		Australia, Radio Australia		15415as	
0030	0100	mtwhfa	Serbia, International Radio of Serbia			9675na
0030	0100		Thailand, Radio Thailand World Service			15275na
0030	0100	Sun	UK, Bible Voice Broadcasting		7405as	
0030	0100		USA, Voice of America/Special English			7430as
			9715as	9780va	11725va	15205va
			15290va	15560va	17820va	
0030	0100		Uzbekistan, CVC Intl/ The Voice Asia			7395as
0045	0100	mtwhf	Moldova, (Transnistria) Radio PMR			9665eu

0100 UTC - 9PM EDT / 8PM CDT / 6PM PDT

0100	0104	twhfa	Canada, Radio Canada International			6100na
0100	0127		Czech Republic, Radio Prague			7345na
0100	0130		Australia, Radio Australia		9660as	12080pa
			13690pa	15240pa	15415as	17715pa
			17750as	17795pa		
0100	0130		Slovakia, Radio Slovakia International			5930na
			9440sa			
0100	0130		Vietnam, Voice of Vietnam		6175na	
0100	0157	DRM	China, China Radio International			6080na
0100	0157		North Korea, Voice of Korea		9345as	9730as
			11735sa	13760as	15180as	
0100	0159		Canada, Radio Canada International			9620as
0100	0200		Anguilla, Worldwide Univ Network			6090am
0100	0200		Australia, ABC NT Alice Springs			4835do
0100	0200		Australia, ABC NT Katherine		5025do	
0100	0200		Australia, ABC NT Tennant Creek			4910do
0100	0200		Bahrain, Radio Bahrain		6010me	9745al
0100	0200		Canada, CFRX Toronto ON		6070na	
0100	0200		Canada, CFVP Calgary AB		6030na	
0100	0200		Canada, CKZN St John's NF		6160na	
0100	0200		Canada, CKZU Vancouver BC		6160na	
0100	0200		China, China Radio International			6005as
			6020eu	6080eu	6175as	7350as
			9570na	9580as	11650as	11730as
			11885as			
0100	0200		Cuba, Radio Havana Cuba		5970na	6000na
			6060na			
0100	0200		Malaysia, RTM/Traxx FM		7295do	
0100	0200		New Zealand, Radio NZ International			13730pa
0100	0200	DRM	New Zealand, Radio NZ International			15720pa
0100	0200		Russia, Voice of Russia		9665na	9890na
0100	0200		Sri Lanka, SLBC		6005as	9770as
0100	0200		Taiwan, Radio Taiwan International			11875as
0100	0200		UK, BBC World Service		5970as	6195as
			7395as	9410as	9740as	11750as
			12095as	13725as	15310as	15335as
			15360as	17615as		
0100	0200		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0100	0200		USA, EWTN/WEWN Vandiver AL			11520af
0100	0200		USA, KJES Vado NM		7555na	
0100	0200		USA, Voice of America		7430va	9780va
			11705va			
0100	0200	Sun	USA, WHRI Cypress Creek SC			5875am
			5920am			
0100	0200		USA, WHRI Cypress Creek SC			5920am
			7315am			
0100	0200		USA, WINB Red Lion PA		9265ca	
0100	0200		USA, WJHR International Milton FL			15550usb
0100	0200		USA, WRMI Miami FL		9955ca	
0100	0200		USA, WRNO New Orleans LA		7505am	
0100	0200		USA, WTJC Newport NC		9370na	
0100	0200		USA, WTWW Lebanon TN		9480na	
0100	0200		USA, WWCR Nashville TN		3215na	4840na
			9980na			
0100	0200		USA, WWRB Manchester TN		3145va	3185va
			5050va	6890va		
0100	0200		USA, WYFR/Family Radio Worldwide			6985na
			7455na	9505na	15440na	
0100	0200		Uzbekistan, CVC Intl/ The Voice Asia			7395as
0100	0200		Zambia, 1 Africa Radio/CVC		4965af	
0130	0200		Iran, VOIRI/IRIB		7245na	9495na
0130	0200	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0130	0200		Sweden, Radio Sweden		6010na	
0130	0200	twhfa	USA, Voice of America/Special English			7465ca
			9820ca			
0140	0200		Vatican City State, Vatican Radio			7335va
			9580va			
0145	0200	twhfas	Albania, Radio Tirana		7425na	

0200 UTC - 10PM EDT / 9PM CDT / 7PM PDT

0200	0215		Croatia, Croatian Radio		3985eu	7375am
0200	0227		Iran, VOIRI/IRIB		7245na	9495na
0200	0230		Thailand, Radio Thailand World Service			15275na
0200	0230		USA, KJES Vado NM		7555na	
0200	0230		Uzbekistan, CVC Intl/ The Voice Asia			7395as
0200	0245		USA, WYFR/Family Radio Worldwide			11835na
0200	0257		China, China Radio International			9550as
			11785as	13640as	15435as	
0200	0257		North Korea, Voice of Korea		13650as	15100as
0200	0300		Anguilla, Worldwide Univ Network			6090am
0200	0300	twhfa	Argentina, Radio Nacional RAE			11710am
0200	0300		Australia, ABC NT Alice Springs			4835do
0200	0300		Australia, ABC NT Katherine		5025do	
0200	0300		Australia, ABC NT Tennant Creek			4910do
0200	0300		Australia, Radio Australia		9660pa	12080pa
			13690pa	15240pa	15415as	15515pa
			17750as	21725pa		
0200	0300		Bahrain, Radio Bahrain		6010me	9745al
0200	0300		Bulgaria, Radio Bulgaria		9700na	11700na
0200	0300		Canada, CFRX Toronto ON		6070na	
0200	0300		Canada, CFVP Calgary AB		6030na	
0200	0300		Canada, CKZN St John's NF		6160na	
0200	0300		Canada, CKZU Vancouver BC		6160na	
0200	0300		Cuba, Radio Havana Cuba		5970na	6000na
			6060na			

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0200	0300		Egypt, Radio Cairo	6270na		
0200	0300		Malaysia, RTM/Traxx FM	7295do		
0200	0300		New Zealand, Radio NZ International	13730pa		
0200	0300	DRM	New Zealand, Radio NZ International	15720pa		
0200	0300	Sun	Palau, T8WH/WHRI/Sound of Hope Radio 15680as			
0200	0300		Philippines, PBS/ Radyo Pilipinas 15285me	17770me	11880me	
0200	0300		Russia, Voice of Russia	9665sa	15425na	
0200	0300		South Korea, KBS World Radio	9580sa		
0200	0300		Sri Lanka, SLBC 6005as	9770as	15745as	
0200	0300		Taiwan, Radio Taiwan International 9680ca		5950na	
0200	0300		Uganda, Radio Uganda	4975do		
0200	0300		UK, BBC World Service 9410as	6005af 12095as	6195as 15310as	
0200	0300		USA, American Forces Network 5446usb 12759usb	5765usb 13362usb	7812usb	4319usb 12133usb
0200	0300		USA, EWTN/WEWN Vandiver AL		11520af	
0200	0300		USA, WHRI Cypress Creek SC 7315am		5875am	
0200	0300		USA, WINB Red Lion PA	9265ca		
0200	0300		USA, WJHR International Milton FL		15550usb	
0200	0300		USA, WRMI Miami FL	9955ca		
0200	0300		USA, WRNO New Orleans LA	7505am		
0200	0300		USA, WTJC Newport NC	9370na		
0200	0300		USA, WTWW Lebanon TN	9480na		
0200	0300		USA, WWCR Nashville TN 5890na	3215na	4840na	
0200	0300		USA, WWRB Manchester TN 5050va	3145va 6890va	3185va	
0200	0300		USA, WYFR/Family Radio Worldwide 6985na	7455na	9385ca	5985ca 9505na
0200	0300		Zambia, 1 Africa Radio/CVC	4965af		
0215	0230		Nepal, Radio Nepal	5005as		
0230	0255	Sun	China, Voice of the Strait	4940do	9505do	
0230	0300	twhfas	Albania, Radio Tirana	7425na		
0230	0300		Sweden, Radio Sweden	6010na	9510va	
0230	0300		Uzbekistan, CVC Intl/ The Voice Asia		11970as	
0230	0300		Vietnam, Voice of Vietnam	6175na		
0245	0300		Australia, HCJB Global	15400as		
0245	0300		India, All India Radio	3945do		
0250	0300		Vatican City State, Vatican Radio 9610am		7305am	

0300 UTC - 11PM EDT / 10PM CDT / 8PM PDT

0300	0315	Sun	Swaziland, TWR Africa	3200af		
0300	0320		Vatican City State, Vatican Radio 9610am		7305am	
0300	0327		Czech Republic, Radio Prague		7345na	
0300	0330		Egypt, Radio Cairo	6270na		
0300	0330		Philippines, PBS/ Radyo Pilipinas 15285me	17770me	11880me	
0300	0330		Sri Lanka, SLBC 6005as	9770as	15745as	
0300	0330		Vatican City State, Vatican Radio 9660af		7360af	
0300	0355		South Africa, Channel Africa	6135af		
0300	0356		Romania, Radio Romania International 9645na	11895as	7335na 15340as	
0300	0357		China, China Radio International 9460na	9690na	6190na 9790as	
0300	0357		North Korea, Voice of Korea 9730as	7200as	9345as	
0300	0400		Anguilla, Worldwide Univ Network		6090am	
0300	0400		Australia, ABC NT Alice Springs		4835do	
0300	0400		Australia, ABC NT Katherine	5025do		
0300	0400		Australia, ABC NT Tennant Creek		4910do	
0300	0400		Australia, Radio Australia 13690pa 17750as	9660as 15240pa 21725pa	12080pa 15415as	15515pa
0300	0400		Bahrain, Radio Bahrain	6010me	9745al	
0300	0400	twhfas	Canada, CBC NQ SW Service	9625na		
0300	0400		Canada, CFRX Toronto ON	6070na		
0300	0400		Canada, CFVP Calgary AB	6030na		
0300	0400		Canada, CKZN St John's NF	6160na		
0300	0400		Canada, CKZU Vancouver BC	6160na		
0300	0400		Cuba, Radio Havana Cuba 6060na	5970na	6000na	
0300	0400		Germany, Deutsche Welle	12005as	15595as	
0300	0400		Malaysia, RTM/Traxx FM	7295do		
0300	0400		New Zealand, Radio NZ International		13730pa	
0300	0400	DRM	New Zealand, Radio NZ International		15720pa	
0300	0400		Oman, Radio Oman	15355af		
0300	0400	Sun	Palau, T8WH/WHRI/Sound of Hope Radio 15680as			
0300	0400		Russia, Voice of Russia 15585as	9665sa	15425na	
0300	0400	DRM	Russia, Voice of Russia	15735as		
0300	0400		South Africa, Channel Africa	3345af		
0300	0400		Taiwan, Radio Taiwan International 15320as		5950na	
0300	0400		Turkey, Voice of Turkey	5975va	6165va	
0300	0400		Uganda, Radio Uganda	4975do		
0300	0400		UK, BBC World Service 6145af 9750af 15310as	3255af 6190af 11945af 17790as	6005af 6195va 12035as	7255af 12095as
0300	0400		USA, American Forces Network 5446usb 12759usb	5765usb 13362usb	7812usb	4319usb 12133usb
0300	0400		USA, EWTN/WEWN Vandiver AL		9455af	
0300	0400		USA, Voice of America 9855af	4930af 15580af	6080af	
0300	0400	mtwhfa	USA, WBCQ Monticello ME	7415am		
0300	0400	Sat	USA, WHRI Cypress Creek SC		7315am	
0300	0400		USA, WINB Red Lion PA	9265ca		
0300	0400		USA, WJHR International Milton FL		15550usb	
0300	0400		USA, WRMI Miami FL	9955ca		
0300	0400		USA, WRNO New Orleans LA	7505am		
0300	0400		USA, WTJC Newport NC	9370na		
0300	0400		USA, WTWW Lebanon TN	9480na		
0300	0400		USA, WWCR Nashville TN 5890na	3215na	4840na	
0300	0400		USA, WWRB Manchester TN 5050va	3145va 6890va	3185va	
0300	0400		USA, WYFR/Family Radio Worldwide 7455na	9505na	11740ca	6985na 15255ca
0300	0400		Zambia, 1 Africa Radio/CVC	4965af		
0300	4000		Uzbekistan, CVC Intl/ The Voice Asia		11970as	
0330	0357		Czech Republic, Radio Prague		9445me	
0330	0400	twhfas	Albania, Radio Tirana	7425na		
0330	0400	Sun	Sri Lanka, SLBC 6005as	9770as	15745as	
0330	0400		UK, BBC World Service	11945af		
0330	0400		Vietnam, Voice of Vietnam	6175na		
0340	0400		Vatican City State, Vatican Radio		15460va	
0345	0400	vl/Sat/Sun	Uganda, Radio Uganda	4975do		

0400 UTC - 12AM EDT / 11PM CDT / 9PM PDT

0400	0430	mtwhf	France, Radio France Internationale 11995af		9805af	
0400	0430		USA, Voice of America 9855af	4930af 12080af	6080af 15580af	
0400	0445		USA, WYFR/Family Radio Worldwide 7455na	9505na	6985na	
0400	0457		China, China Radio International 9460na 17855as	13620as	6190na 15120as	17725as
0400	0458		New Zealand, Radio NZ International		13730pa	
0400	0458	DRM	New Zealand, Radio NZ International		15720pa	
0400	0500		Anguilla, Worldwide Univ Network		6090am	
0400	0500		Australia, ABC NT Alice Springs		4835do	
0400	0500		Australia, ABC NT Katherine	5025do		
0400	0500		Australia, ABC NT Tennant Creek		4910do	
0400	0500		Australia, Radio Australia 13690pa 21725pa	9660pa 15240pa	12080pa 15515pa	17750as
0400	0500		Bahrain, Radio Bahrain	6010me	9745al	
0400	0500	twhfas	Canada, CBC NQ SW Service	9625na		
0400	0500		Canada, CFRX Toronto ON	6070na		
0400	0500		Canada, CKZN St John's NF	6160na		
0400	0500		Canada, CKZU Vancouver BC	6160na		
0400	0500		Cuba, Radio Havana Cuba 6060na	5970na	6000na	
0400	0500		Germany, Deutsche Welle 12045af	6180af 15400af	7240af	
0400	0500		Malaysia, RTM/Traxx FM	7295do		
0400	0500		Russia, Voice of Russia	13775na	15585as	
0400	0500	DRM	Russia, Voice of Russia	15735as		
0400	0500		South Africa, Channel Africa	3345af		
0400	0500	Sun	Sri Lanka, SLBC 6005as	9770as	15745as	
0400	0500		Uganda, Radio Uganda	4975do		
0400	0500		UK, BBC World Service 6190af 12035as 15360as	3255af 7255af 13675eu 17790as	6055af 7310af	9410eu 15310as
0400	0500		USA, American Forces Network 5446usb 12759usb	5765usb 13362usb	7812usb	4319usb 12133usb

0400	0500		USA, EWTN/WEWN Vandiver AL			9455af
0400	0500	Sun	USA, WHRI Cypress Creek SC			7365eu
0400	0500	Sat	USA, WHRI Cypress Creek SC			9825me
0400	0500		USA, WJHR International Milton FL			15550usb
0400	0500		USA, WRMI Miami FL	9955ca		
0400	0500		USA, WRNO New Orleans LA	7505am		
0400	0500		USA, WTJC Newport NC	9370na		
0400	0500		USA, WTWW Lebanon TN	9480na		
0400	0500		USA, WWCR Nashville TN	3215na	4840na	5890na
0400	0500		USA, WWRB Manchester TN	3185va		
0400	0500		USA, WYFR/Family Radio Worldwide			5985na 9680na
0400	0500		Uzbekistan, CVC Intl/ The Voice Asia			11970as
0400	0500		Zambia, 1 Africa Radio/CVC	4965af		9430af 5925al
0430	0500		Australia, Radio Australia	15415as		
0430	0500	mtwhf	Swaziland, TWR Africa	3200af		4775af
0430	0500		USA, Voice of America	4930af		4960af 6080af 12080af 15580af
0445	0500		Nigeria, Voice of Nigeria/External Service			15120eu
0459	0500		New Zealand, Radio NZ International			11725pa
0459	0500	DRM	New Zealand, Radio NZ International			11675pa

0500 UTC - 1AM EDT / 12AM CDT / 10PM PDT

0500	0507	twhfas	Canada, CBC NQ SW Service	9625na		
0500	0520		Vatican City State, Vatican Radio			4005eu 5965eu 7250eu
0500	0530		China, CNR-11/Holy Tibet	9530do		11685do 15570do
0500	0530		Czech Republic, Radio Prague			9955ca
0500	0530	mtwhf	France, Radio France Internationale			11995af 13680af
0500	0530		Germany, Deutsche Welle	6180af		7430af 9700af 9825af
0500	0530		Japan, NHK World/ Radio Japan			5975va 6110na 11970as 15205as 17810as
0500	0530	Sun	UK, BBC World Service	15420af		
0500	0530		Vatican City State, Vatican Radio			9660af 11625af 13765af
0500	0600		Anguilla, Worldwide Univ Network			6090am
0500	0600		Australia, ABC NT Alice Springs			4835do
0500	0600		Australia, ABC NT Katherine	5025do		
0500	0600		Australia, ABC NT Tennant Creek			4910do
0500	0600		Australia, Radio Australia	9660pa		12080pa 13630as 13690pa 17750as
0500	0600		Bahrain, Radio Bahrain	6010me		9745al
0500	0600		Bhutan, Bhutan Broadcasting Service			6035as
0500	0600		Canada, CFRX Toronto ON	6070na		
0500	0600		Canada, CKZN St John's NF	6160na		
0500	0600		Canada, CKZU Vancouver BC	6160na		
0500	0600		China, China Radio International			5960na 6190af 7220as 11880as 15350as 15465as
0500	0600	Sat/Sun	Clandestine, Sudan Radio Service/ SRS			13720af
0500	0600		Cuba, Radio Havana Cuba	5970na		6010na 6010na 6060na
0500	0600	DRM	Germany, Deutsche Welle	17525as		
0500	0600		Kuwait, Radio Kuwait	15110as		
0500	0600		Malaysia, RTM/Traxx FM	7295do		
0500	0600		New Zealand, Radio NZ International			11725pa
0500	0600	DRM	New Zealand, Radio NZ International			11675pa
0500	0600		Nigeria, Voice of Nigeria/External Service			15120eu
0500	0600		Russia, Voice of Russia	13775na		
0500	0600	mtwh	Slovakia, IRRS/Euro Gospel Radio			5990va
0500	0600		South Africa, Channel Africa	7230af		
0500	0600		Swaziland, TWR Africa	3200af		6120af 9500af
0500	0600		Taiwan, Radio Taiwan International			5950na
0500	0600		Uganda, Radio Uganda	4975do		
0500	0600		UK, BBC World Service	3995eu		7255af 7310af 9410eu 11945af 12095va 15310as 15360as 15560eu 17640af 17790as
0500	0600	mtwhf	UK, BBC World Service	15420af		
0500	0600		USA, American Forces Network			4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0500	0600		USA, EWTN/WEWN Vandiver AL			6890va
0500	0600		USA, Voice of America	4930af		6080af 12080af 15580af
0500	0600	Sun	USA, WHRI Cypress Creek SC			11565pa
0500	0600		USA, WJHR International Milton FL			15550usb
0500	0600		USA, WRMI Miami FL	9955ca		
0500	0600		USA, WTJC Newport NC	9370na		
0500	0600		USA, WTWW Lebanon TN	9480na		
0500	0600		USA, WWCR Nashville TN	3215na	4840na	
0500	0600		USA, WWRB Manchester TN	3185va		
0500	0600		USA, WYFR/Family Radio Worldwide			5985na 9680na
0500	0600		Uzbekistan, CVC Intl/ The Voice Asia			11970as
0500	0600		Zambia, 1 Africa Radio/CVC	9430af		
0515	0530		Rwanda, Radio Rwanda	6055do		
0530	0556		Romania, Radio Romania International			9655eu 17760pa 21500pa
0530	0556	DRM	Romania, Radio Romania International			7305eu
0530	0600		Thailand, Radio Thailand World Service			17655eu

0600 UTC - 2AM EDT / 1AM CDT / 11PM PDT

0600	0630	Sat/Sun	Australia, Radio Australia	15180as		15290as 15415as
0600	0630		China, Xizang PBS/Holy Tibet	4905do		4920do 5240do 6110do 6130do 6200do 9490do 9580do
0600	0630	mtwhf	France, Radio France Internationale			9765af 11615af 15160af 17800af
0600	0630		Germany, Deutsche Welle	7325af		15275af
0600	0630		Laos, Lao National Radio	7145as		
0600	0630		Uzbekistan, CVC Intl/ The Voice Asia			11970as
0600	0645	mtwhf	South Africa, TWR	11640af		
0600	0645		Vatican City State, Vatican Radio			4005eu 5965eu 7250eu 9645eu 11740eu 15595eu
0600	0657		China, China Radio International			6115af 11750af 11770as 11880as 13645as 15145as 15350as 15465as 17505va 17540as 17710as
0600	0658		New Zealand, Radio NZ International			11725pa
0600	0658	DRM	New Zealand, Radio NZ International			11675pa
0600	0700		Anguilla, Worldwide Univ Network			6090am
0600	0700		Australia, ABC NT Alice Springs			4835do
0600	0700		Australia, ABC NT Katherine	5025do		
0600	0700		Australia, ABC NT Tennant Creek			4910do
0600	0700		Australia, Radio Australia	9660pa		12080pa 13630as 13690pa 15160pa 15240pa 17750as
0600	0700		Bahrain, Radio Bahrain	6010me		9745al
0600	0700		Canada, CFRX Toronto ON	6070na		
0600	0700		Canada, CFVP Calgary AB	6030na		
0600	0700		Canada, CKZN St John's NF	6160na		
0600	0700		Canada, CKZU Vancouver BC	6160na		
0600	0700		Cuba, Radio Havana Cuba	5970na		6000na 6010na 6060na
0600	0700	DRM	Germany, Deutsche Welle	3995eu		6130eu
0600	0700		Greece, Voice of Greece	11645eu		
0600	0700		Kuwait, Radio Kuwait	15110as		
0600	0700		Malaysia, RTM/Traxx FM	7295do		
0600	0700		Malaysia, RTM/Voice of Malaysia			6175as 9750as 15295as
0600	0700		Nigeria, Voice of Nigeria/External Service			15120eu
0600	0700	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			15680as
0600	0700		Russia, Voice of Russia	15405pa		
0600	0700		South Africa, Channel Africa	7230af		
0600	0700		Swaziland, TWR Africa	4775af		6120af 9500af
0600	0700		Uganda, Radio Uganda	7195do		
0600	0700		UK, BBC World Service	3995eu		6005af 6190af 7310af 9410af 9860af 12015af 12095as 15310as 17640af 17790as
0600	0700	Sat/Sun	UK, BBC World Service	15420af		
0600	0700	DRM	UK, BBC World Service	3995eu		
0600	0700		USA, American Forces Network			4319usb 5446usb 5765usb 7812usb 12133usb 12759usb 13362usb
0600	0700		USA, EWTN/WEWN Vandiver AL			6890va
0600	0700		USA, Voice of America	6080af		12080af 15580af
0600	0700	Sun	USA, WHRI Cypress Creek SC			7365eu
0600	0700		USA, WJHR International Milton FL			15550usb
0600	0700		USA, WRMI Miami FL	9955ca		
0600	0700		USA, WTJC Newport NC	9370na		
0600	0700		USA, WTWW Lebanon TN	9480na		
0600	0700		USA, WWCR Nashville TN	3215na	4840na	

0600	0700		USA, WWRB Manchester TN	3185va		
0600	0700		USA, WYFR/Family Radio Worldwide	5850ca		
			7520eu	9680na	11530af	11580eu
0600	0700		Zambia, 1 Africa Radio/CVC	6065af	13590af	
0600	615	Sat/Sun	South Africa, TWR	11640af		
0630	0700		Australia, Radio Australia	15415as		
0630	0700		Bulgaria, Radio Bulgaria	9600eu	11600eu	
0630	0700		Uzbekistan, CVC Intl/ The Voice Asia	15700as		
0630	0700		Vatican City State, Vatican Radio	11625af		
			13765af	15570af		
0645	0700	Sun	Germany, TWR Europe	6105eu		
0645	0700	Sun	Monaco, TWR Europe	9800eu		
0659	0700		New Zealand, Radio NZ International	6170pa		
0659	0700	DRM	New Zealand, Radio NZ International	7440pa		

0700 UTC - 3AM EDT / 2AM CDT / 12AM PDT

0700	0727		Czech Republic, Radio Prague	9880eu		
0700	0730	mtwhf	France, Radio France Internationale	13675af		
0700	0730		Slovakia, Radio Slovakia International	9440va		
			11650va			
0700	0730	Sun	UK, Bible Voice Broadcasting	5945eu		
0700	0745	Sat	UK, Bible Voice Broadcasting	5945eu		
0700	0745		USA, WYFR/Family Radio Worldwide	7520eu		
0700	0750	Sun	Germany, TWR Europe	6105eu		
0700	0750	mtwhf	Germany, TWR Europe	6105eu		
0700	0750	mtwhf	Monaco, TWR Europe	9800eu		
0700	0757		China, China Radio International	11785as		
			11880as	13645as	15125eu	15350as
			15465as	17505as	17540as	17710as
0700	0800		Anguilla, Worldwide Univ Network	6090am		
0700	0800		Australia, ABC NT Alice Springs	4835do		
0700	0800		Australia, ABC NT Katherine	5025do		
0700	0800		Australia, ABC NT Tennant Creek	4910do		
0700	0800		Australia, Radio Australia	9475as	9660pa	
			9710as	11945pa	12080pa	13630as
			15160pa	15240pa		
0700	0800		Bahrain, Radio Bahrain	6010me	9745al	
0700	0800	m/DRM	Belgium, TDP Radio	6015eu		
0700	0800		Canada, CFRX Toronto ON	6070na		
0700	0800		Canada, CFVP Calgary AB	6030na		
0700	0800		Canada, CKZN St John's NF	6160na		
0700	0800		Canada, CKZU Vancouver BC	6160na		
0700	0800	mtwhf	Equatorial Guinea, Radio Africa # 2	15190af		
0700	0800	Sat/Sun	Equatorial Guinea, Radio East Africa	15190af		
0700	0800	DRM	Germany, Deutsche Welle	5790eu	9545eu	
0700	0800		Kuwait, Radio Kuwait	15110as		
0700	0800		Malaysia, RTM/Traxx FM	7295do		
0700	0800		Malaysia, RTM/Voice of Malaysia	6175as		
			9750as	15295as		
0700	0800		Myanmar, Myanma Radio	9730do		
0700	0800		New Zealand, Radio NZ International	6170pa		
0700	0800	DRM	New Zealand, Radio NZ International	7440pa		
0700	0800	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			15680as			
0700	0800		Russia, Voice of Russia	15405pa	17495va	
0700	0800		South Africa, Channel Africa	7230af		
0700	0800		Swaziland, TWR Africa	4775af	6120af	
			9500af			
0700	0800		Uganda, Radio Uganda	7195do		
0700	0800		UK, BBC World Service	5790eu	6190af	
			9860af	11760me	11765af	13830af
			15400af	15575as	17790as	17830af
0700	0800	Sat/Sun	UK, BBC World Service	15420af		
0700	0800		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0700	0800		USA, EWTN/WEWN Vandiver AL	6890va		
0700	0800	Sun	USA, WHRI Cypress Creek SC	11565pa		
0700	0800		USA, WJHR International Milton FL	15550usb		
0700	0800		USA, WRMI Miami FL	9955ca		
0700	0800		USA, WTJC Newport NC	9370na		
0700	0800		USA, WTWW Lebanon TN	9480na		
0700	0800		USA, WWCR Nashville TN	3215na	4840na	
0700	0800		USA, WWRB Manchester TN	3185va		
0700	0800		USA, WYFR/Family Radio Worldwide	5950na		
			5985na	6875na	9385af	9505ca
0700	0800		Uzbekistan, CVC Intl/ The Voice Asia	15700as		
0700	0800		Zambia, 1 Africa Radio/CVC	6065af	13590af	
0715	0750	Sat	Germany, TWR Europe	6105eu		
0715	0750	Sat	Monaco, TWR Europe	9800eu		
0730	0800		Australia, HCJB Global	11750as		
0730	0800		Clandestine, Cotton Tree News	11875af		

0800 UTC - 4AM EDT / 3AM CDT / 1AM PDT

0800	0830		Australia, ABC NT Alice Springs	4835do		
0800	0830		Australia, ABC NT Katherine	5025do		
0800	0830		Australia, ABC NT Tennant Creek	4910do		
0800	0830		Myanmar, Myanma Radio	9730do		
0800	0845		USA, WYFR/Family Radio Worldwide	5950na		
			9385af			
0800	0857		China, China Radio International	9415as		
			11785as	11880as	15350as	15465as
			15625as	15465as	15625as	17490eu
			17540as			
0800	0900		Anguilla, Worldwide Univ Network	6090am		
0800	0900		Australia, HCJB Global	11750pa		
0800	0900		Australia, Radio Australia	5995pa	9475as	
			9580pa	9590pa	9710pa	11945pa
			12080pa	13630as		
0800	0900		Bahrain, Radio Bahrain	6010me	9745al	
0800	0900	t/DRM	Belgium, TDP Radio	6015eu		
0800	0900		Bhutan, Bhutan Broadcasting Service	6035as		
0800	0900		Canada, CFRX Toronto ON	6070na		
0800	0900		Canada, CFVP Calgary AB	6030na		
0800	0900		Canada, CKZN St John's NF	6160na		
0800	0900		Canada, CKZU Vancouver BC	6160na		
0800	0900		China, Guangxi FBS/Beibu Bay Radio	5050as		
			9820as			
0800	0900	mtwhf	Equatorial Guinea, Radio Africa # 2	15190af		
0800	0900	Sat/Sun	Equatorial Guinea, Radio East Africa	15190af		
0800	0900	DRM	Germany, Deutsche Welle	12095as		
0800	0900		Malaysia, RTM/Traxx FM	7295do		
0800	0900		Malaysia, RTM/Voice of Malaysia	6175as		
			9750as	15295as		
0800	0900		New Zealand, Radio NZ International	6170pa		
0800	0900	DRM	New Zealand, Radio NZ International	7440pa		
0800	0900		Nigeria, Voice of Nigeria/External Service			
			9690af			
0800	0900	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
0800	0900		Russia, Voice of Russia	15405pa	17495va	
0800	0900	DRM	Russia, Voice of Russia	12060eu		
0800	0900		South Africa, Channel Africa	9625af		
0800	0900	Sun	South Africa, Radio League	7205af	17570af	
0800	0900		South Korea, KBS World Radio	9570as		
0800	0900		Swaziland, TWR Africa	4775af	6120af	
			9500af			
0800	0900		Uganda, Radio Uganda	7195do		
0800	0900		UK, BBC World Service	6190af	9860af	
			11760me	15310as	15400af	15575as
			17640af	17790as	17830af	21470af
0800	0900		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0800	0900		USA, EWTN/WEWN Vandiver AL	6890va		
0800	0900		USA, KNLS Anchor Point AK	11765as		
0800	0900	smtwhf	USA, WHRI Cypress Creek SC	11565pa		
0800	0900		USA, WJHR International Milton FL	15550usb		
0800	0900		USA, WRMI Miami FL	9955ca		
0800	0900		USA, WTJC Newport NC	9370na		
0800	0900		USA, WTWW Lebanon TN	9480na		
0800	0900		USA, WWCR Nashville TN	3215na	4840na	
0800	0900		USA, WWRB Manchester TN	3185va		
0800	0900		USA, WYFR/Family Radio Worldwide	5985na		
			6875na			
0800	0900		Uzbekistan, CVC Intl/ The Voice Asia	15700as		
0800	0900		Zambia, 1 Africa Radio/CVC	6065af	13590af	
0815	0825		Nepal, Radio Nepal	5005as		
0820	0900	smtwhf	Guam, KTWR/TWR	15170as		
0830	0900		Australia, ABC NT Alice Springs	2310do		
0830	0900		Australia, ABC NT Katherine	2485do		
0830	0900		Australia, ABC NT Tennant Creek	2325do		
0830	0900	mtwhfa	Guam, KTWR/TWR	11840pa		

0900 UTC - 5AM EDT / 4AM CDT / 2AM PDT

0900	0910	mtwhfa	Guam, KTWR/TWR	11840pa		
0900	0929		Czech Republic, Radio Prague	17650af		
0900	0930		Australia, HCJB Global	11750pa		
0900	0930	DRM	Bulgaria, Radio Bulgaria	11900eu		
0900	0930	Sat	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
0900	0930		Uzbekistan, CVC Intl/ The Voice Asia	15700as		
0900	0957		China, China Radio International	9415as		
			15210va	15270eu	15350as	17490eu
			17570eu	17690va	17750as	

0900	0959		Germany, Deutsche Welle	15640as	17820as	
0900	1000		Anguilla, Worldwide Univ Network		6090am	
0900	1000		Australia, ABC NT Alice Springs		2310do	
0900	1000		Australia, ABC NT Katherine	2485do		
0900	1000		Australia, ABC NT Tennant Creek		2325do	
0900	1000		Australia, Radio Australia	9475as	9580pa	
			9590pa	11945pa		
0900	1000		Bahrain, Radio Bahrain	6010me	9745al	
0900	1000	w/DRM	Belgium, TDP Radio	6015eu		
0900	1000		Canada, CFRX Toronto ON	6070na		
0900	1000		Canada, CFVP Calgary AB	6030na		
0900	1000		Canada, CKZN St John's NF	6160na		
0900	1000		Canada, CKZU Vancouver BC	6160na		
0900	1000		China, Guangxi FBS/Beibu Bay Radio		5050as	
			9820as			
0900	1000	mtwhf	Equatorial Guinea, Radio Africa # 2		15190af	
0900	1000	Sat/Sun	Equatorial Guinea, Radio East Africa		15190af	
0900	1000	2nd Sun	Germany, Blue Star Radio	6140eu		
0900	1000		Malaysia, RTM/Traxx FM	7295do		
0900	1000		Malaysia, RTM/Voice of Malaysia		6175as	
			9750as	15295as		
0900	1000		New Zealand, Radio NZ International		6170pa	
0900	1000	DRM	New Zealand, Radio NZ International		7440pa	
0900	1000		Nigeria, Voice of Nigeria/External Service			
			9690af			
0900	1000		Russia, Voice of Russia	15170as	17495va	
0900	1000	DRM	Russia, Voice of Russia	12060eu		
0900	1000	3rd Sat	Slovakia, IRRS/Radio City	9510va		
0900	1000	1st Sat	Slovakia, IRRS/Radio Joystick	9510va		
0900	1000		Tajikistan, Voice of Tajik/External Svc		7245va	
0900	1000		Uganda, Radio Uganda	7195do		
0900	1000	DRM	UK, BBC World Service	9610eu	13810eu	
0900	1000		UK, BBC World Service	6190af	6195as	
			9740as	9860af	11760me	15310as
			15400af	15575as	17640af	17760as
			17830af	21470af	21660as	
0900	1000		USA, American Forces Network		4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
0900	1000		USA, EWTN/WEWN Vandiver AL		11520va	
0900	1000	Sun	USA, WHRI Cypress Creek SC		11565pa	
0900	1000		USA, WJHR International Milton FL		15550usb	
0900	1000		USA, WRMI Miami FL	9955ca		
0900	1000		USA, WTJC Newport NC	9370na		
0900	1000		USA, WTWW Lebanon TN	9480na		
0900	1000		USA, WWCR Nashville TN	4840na	9985na	
0900	1000		USA, WWRB Manchester TN	3185va		
0900	1000		USA, WYFR/Family Radio Worldwide		5985na	
			6875na	9465as	9755na	
0900	1000		Zambia, 1 Africa Radio/CVC	6065af	13590af	
0915	0930	mtwhf	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
0930	1000		Saudi Arabia, BSKSA/Saudi Radio		15250af	
0930	1000	Sun	Slovakia, IRRS/Euro Gospel Radio		9515va	

1000 UTC - 6AM EDT / 5AM CDT / 3AM PDT

1000	1025		China, Voice of the Strait	4940do	9505do	
1000	1030		Czech Republic, Radio Prague		9955na	
1000	1030		Japan, NHK World/ Radio Japan		9605as	
			9625pa	9825pa	11780as	
1000	1030	fa	Philippines, FEBC	15325as		
1000	1030		Vietnam, Voice of Vietnam	9840as	12020as	
1000	1057		China, China Radio International		5955na	
			7215as	11640as	13590as	13720va
			15190as	15210as	15350as	17490eu
			17690va			
1000	1057		Netherlands, R Netherlands Worldwide		11895as	
			12065as	15110as		
1000	1057		North Korea, Voice of Korea	11710sa	11735sa	
			13650as	15180sa		
1000	1058		New Zealand, Radio NZ International		6170pa	
1000	1100		Anguilla, Worldwide Univ Network		6090am	
1000	1100		Australia, ABC NT Alice Springs		2310do	
1000	1100		Australia, ABC NT Katherine	2485do		
1000	1100		Australia, ABC NT Tennant Creek		2325do	
1000	1100		Australia, Radio Australia	9475as	9580pa	
			9590pa	11945pa		
1000	1100		Bahrain, Radio Bahrain	6010me	9745al	
1000	1100	h/DRM	Belgium, TDP Radio	6015eu		
1000	1100		Canada, CFRX Toronto ON	6070na		
1000	1100		Canada, CFVP Calgary AB	6030na		
1000	1100		Canada, CKZN St John's NF	6160na		
1000	1100		Canada, CKZU Vancouver BC	6160na		
1000	1100	mtwhf	Equatorial Guinea, Radio Africa # 2		15190af	
1000	1100	Sat/Sun	Equatorial Guinea, Radio East Africa		15190af	
1000	1100	DRM	Germany, Deutsche Welle	9545eu	13810eu	
1000	1100	3rd Sun	Germany, European Music Radio		6140eu	
1000	1100	4th Sun	Germany, Radio Gloria International		6140eu	
1000	1100		India, All India Radio	7270as	13695pa	
			15020as	15260as	15410as	17510pa
			17895pa			
1000	1100		Indonesia, Voice of Indonesia	9526va	11785al	
1000	1100		Malaysia, RTM/Traxx FM	7295do		
1000	1100	DRM	New Zealand, Radio NZ International		7440pa	
1000	1100		Nigeria, Voice of Nigeria/External Service			
			9690af			
1000	1100		Russia, Voice of Russia	15170as		
1000	1100	Sun	Slovakia, IRRS/Euro Gospel Radio		9515va	
1000	1100		Uganda, Radio Uganda	7195do		
1000	1100	DRM	UK, BBC World Service	9545eu	13810eu	
1000	1100	Sat/Sun	UK, BBC World Service	15400af	17830af	
1000	1100		UK, BBC World Service	6190af	6195as	
			9545eu	9740as	9860af	11760me
			15310as	15575as	17640af	17790as
			21470af	21660as		
1000	1100		USA, American Forces Network		4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1000	1100		USA, EWTN/WEWN Vandiver AL		11520va	
1000	1100		USA, KNLS Anchor Point AK	11765as		
1000	1100	Sun	USA, WHRI Cypress Creek SC		11565pa	
1000	1100		USA, WJHR International Milton FL		15550usb	
1000	1100		USA, WRMI Miami FL	9955ca		
1000	1100		USA, WTJC Newport NC	9370na		
1000	1100		USA, WTWW Lebanon TN	9480na		
1000	1100		USA, WWCR Nashville TN	4840na	9985na	
1000	1100		USA, WWRB Manchester TN	3185va		
1000	1100		USA, WYFR/Family Radio Worldwide		5950na	
			5985na	6875na	9460as	9465va
			9755na			
1000	1100		Zambia, 1 Africa Radio/CVC	6065af	13590af	
1030	1057		Czech Republic, Radio Prague		9880eu	
1030	1100		Iran, VOIRI/IRIB	15600as	17660as	
1030	1100		Mongolia, Voice of Mongolia	12085as		
1030	1100	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
1059	1100		New Zealand, Radio NZ International		9655pa	

1100 UTC - 7AM EDT / 6AM CDT / 4AM PDT

1100	1127		Iran, VOIRI/IRIB	15600as	17660as	
1100	1130	f/DRM	Japan, NHK World/ Radio Japan		9760eu	
1100	1130	Sat/DRM	South Korea, KBS World Radio		9760eu	
1100	1130	mtwhf	UK, BBC World Service	15400af		
1100	1130		Vietnam, Voice of Vietnam	7285as		
1100	1145		USA, WYFR/Family Radio Worldwide		9550ca	
			9755na			
1100	1156		Romania, Radio Romania International		15210eu	
			15430eu	17510af	17670af	
1100	1157		China, China Radio International		5955as	
			5960na	6060as	9570as	11650as
			11795as	13590va	13645eu	13665eu
			13720as	17490va		
1100	1158	DRM	New Zealand, Radio NZ International		7440pa	
1100	1200		Anguilla, Worldwide Univ Network		11775am	
1100	1200		Australia, ABC NT Alice Springs		2310do	
1100	1200		Australia, ABC NT Katherine	2485do		
1100	1200		Australia, ABC NT Tennant Creek		2325do	
1100	1200		Australia, Radio Australia	5995pa	6020pa	
			9475as	9560pa	9580pa	9590pa
			11945pa	12080pa	17880as	
1100	1200		Bahrain, Radio Bahrain	6010me	9745al	
1100	1200	f/DRM	Belgium, TDP Radio	6015eu		
1100	1200	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1100	1200		Canada, CFRX Toronto ON	6070na		
1100	1200		Canada, CFVP Calgary AB	6030na		
1100	1200		Canada, CKZN St John's NF	6160na		
1100	1200		Canada, CKZU Vancouver BC	6160na		
1100	1200	mtwhf	Equatorial Guinea, Radio Africa # 2		15190af	
1100	1200	Sat/Sun	Equatorial Guinea, Radio East Africa		15190af	
1100	1200		Malaysia, RTM/Traxx FM	7295do		
1100	1200		New Zealand, Radio NZ International		9655pa	
1100	1200		Nigeria, Voice of Nigeria/External Service			
			9690af			
1100	1200	Sat/Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
1100	1200		Russia, Voice of Russia	12065as		
1100	1200		Saudi Arabia, BSKSA/Saudi Radio		15250af	
1100	1200	Sun	Slovakia, IRRS/Euro Gospel Radio		9515va	

1100	1200		Taiwan, Radio Taiwan International			7445as
			11715as			
1100	1200		Uganda, Radio Uganda		7195do	
1100	1200		UK, BBC World Service		6190af	6195as
			9545eu	9740as	9860af	11760me
			15280as	15310as	15575as	17640af
			17790as	17830af	21470af	
1100	1200		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1100	1200		USA, EWTN/WEWN Vandiver AL			11520va
1100	1200		USA, WINB Red Lion PA		9265ca	
1100	1200		USA, WJHR International Milton FL			15550usb
1100	1200		USA, WRMI Miami FL		9955ca	
1100	1200		USA, WTJC Newport NC		9370na	
1100	1200		USA, WTWW Lebanon TN		9480na	
1100	1200		USA, WWCR Nashville TN		4840na	5890na
			15825na			
1100	1200		USA, WWRB Manchester TN		3185va	
1100	1200		USA, WYFR/Family Radio Worldwide			6875na
			7730ca	9625ca		
1100	1200		Zambia, 1 Africa Radio/CVC		6065af	13590af
1130	1150	f	Vatican City State, Vatican Radio			15595as
			17765as			
1130	1200	Sat/Sun	Australia, HCJB Global		15400as	
1130	1200		Vietnam, Voice of Vietnam		9840as	12020as
1145	1200	Sat/Sun	UK, Bible Voice Broadcasting		5945as	

1200 UTC - 8AM EDT / 7AM CDT / 5AM PDT

1200	1215		Nepal, Radio Nepal		5005as	
1200	1215	Sat/Sun	UK, Bible Voice Broadcasting		5945as	
1200	1230	mtwhf	France, Radio France Internationale			17800af
			21620af			
1200	1230		Germany, AWR Europe		15435as	
1200	1230		Japan, NHK World/ Radio Japan			6120na
			9625pa	9695as	9790eu	
1200	1230		Saudi Arabia, BSKSA/Saudi Radio			15250af
1200	1230	mtwhfa	Vatican City State, Vatican Radio			9830am
1200	1245		USA, WYFR/Family Radio Worldwide			5950na
			6875na			
1200	1257		China, China Radio International			5955as
			7250as	9460as	9600as	9645as
			9730va	9760as	11650as	11690as
			11760va	11980as	12015as	13665eu
			13790eu	17490eu		
1200	1258		New Zealand, Radio NZ International			9655pa
1200	1259		Poland, Polskie Radio Warsaw			11675eu
			11980eu			
1200	1300		Anguilla, Worldwide Univ Network			11775am
1200	1300		Australia, ABC NT Alice Springs			2310do
1200	1300		Australia, ABC NT Katherine		2485do	
1200	1300		Australia, ABC NT Tennant Creek			2325do
1200	1300	Sat/Sun	Australia, HCJB Global		15400as	
1200	1300		Australia, Radio Australia		5995pa	6020pa
			9475as	9560pa	9580pa	9590pa
			11945pa	17880as	17880as	
1200	1300		Bahrain, Radio Bahrain		6010me	9745al
1200	1300	a/DRM	Belgium, TDP Radio		6015eu	
1200	1300	Sat/Sun	Canada, CBC NQ SW Service		9625na	
1200	1300		Canada, CFRX Toronto ON		6070na	
1200	1300		Canada, CFVP Calgary AB		6030na	
1200	1300		Canada, CKZN St John's NF		6160na	
1200	1300		Canada, CKZU Vancouver BC		6160na	
1200	1300	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1200	1300	mtwhf	Ethiopia, Radio Ethiopia/National Service			5990do
			7110do	9704do		
1200	1300	DRM	Germany, Deutsche Welle		9545eu	13810eu
1200	1300		Malaysia, RTM/Traxx FM		7295do	
1200	1300		Nigeria, Voice of Nigeria/External Service			
			9690af			
1200	1300	Sun	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			
1200	1300		Russia, Voice of Russia		11500as	11755as
1200	1300		South Korea, KBS World Radio			9650na
1200	1300		Uganda, Radio Uganda		7195do	
1200	1300		UK, BBC World Service		5875as	6190af
			6195as	9545eu	9740as	9860af
			11750as	11760me	15310as	15575as
			17640af	17790as	17830af	
1200	1300		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1200	1300		USA, EWTN/WEWN Vandiver AL			11520va
1200	1300		USA, KNLS Anchor Point AK		11765as	12105as
1200	1300		USA, Voice of America		7575va	9510va
			9760va	12075va		
1200	1300		USA, WHRI Cypress Creek SC			7315na
1200	1300	Sun	USA, WHRI Cypress Creek SC			9410ca
1200	1300		USA, WINB Red Lion PA		9265ca	
1200	1300		USA, WJHR International Milton FL			15550usb
1200	1300		USA, WRMI Miami FL		9955ca	
1200	1300		USA, WTJC Newport NC		9370na	
1200	1300		USA, WTWW Lebanon TN		9480na	
1200	1300		USA, WWCR Nashville TN		7490af	9980na
			13845na	15825na		
1200	1300		USA, WWRB Manchester TN		3185va	
1200	1300		USA, WYFR/Family Radio Worldwide			17555ca
			17795na			
1200	1300		Zambia, 1 Africa Radio/CVC		6065af	13590af
1215	1300		Egypt, Radio Cairo		17870as	
1215	1300	mtwhyf	UK, BBC World Service		9410ca	11860ca
1230	1300	mtwhf	Australia, FEBA Radio		15400as	
1230	1300	mtwhf	Australia, HCJB Global		15400as	
1230	1300		Bangladesh, Bangladesh Betar			7250as
1230	1300		Thailand, Radio Thailand World Service			9890va
1230	1300		Vietnam, Voice of Vietnam		9840as	12020as
1230	13000		Turkey, Voice of Turkey		15450eu	15520as
1245	1300	Sat	Palau, T8WH/WHRI/Sound of Hope Radio			
			9930as			

1300 UTC - 9AM EDT / 8AM CDT / 6AM PDT

1300	1329		Czech Republic, Radio Prague			11600eu
1300	1330		Australia, HCJB Global		15400as	
1300	1330		Egypt, Radio Cairo		17870as	
1300	1330		Japan, NHK World/ Radio Japan			11985as
1300	1330		Turkey, Voice of Turkey		15520as	
1300	1357		China, China Radio International			5995as
			7300na	9570na	9730as	9765va
			9870as	11760as	11885as	11900eu
			11980as	13790eu	15230na	17490va
1300	1357		North Korea, Voice of Korea		9335eu	11710na
			13760as	15245eu		
1300	1400		Anguilla, Worldwide Univ Network			11775am
1300	1400		Australia, ABC NT Alice Springs			2310do
1300	1400		Australia, ABC NT Katherine		2485do	
1300	1400		Australia, Radio Australia		5995pa	6020pa
			9560pa	9580pa	9590pa	
1300	1400		Bahrain, Radio Bahrain		6010me	9745al
1300	1400	s/DRM	Belgium, TDP Radio		6015na	
1300	1400	Sat/Sun	Canada, CBC NQ SW Service		9625na	
1300	1400		Canada, CFRX Toronto ON		6070na	
1300	1400		Canada, CFVP Calgary AB		6030na	
1300	1400		Canada, CKZN St John's NF		6160na	
1300	1400		Canada, CKZU Vancouver BC		6160na	
1300	1400	Sat/Sun	Equatorial Guinea, Radio East Africa			15190af
1300	1400		Indonesia, Voice of Indonesia		9526va	11785al
1300	1400		Malaysia, RTM/Traxx FM		7295do	
1300	1400		New Zealand, Radio NZ International			6170pa
1300	1400		Nigeria, Voice of Nigeria/External Service			
			9690af			
1300	1400		Russia, Voice of Russia		12065as	
1300	1400		South Korea, KBS World Radio			9770as
1300	1400		Tajikistan, Voice of Tajik/External Svc			7245va
1300	1400		Uganda, Radio Uganda		4975do	
1300	1400		UK, BBC World Service		5875as	6190af
			6195as	9545eu	9740as	9860af
			11760me	15310as	15420af	15575as
			17640af	17790as	17830af	21470af
1300	1400		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1300	1400		USA, EWTN/WEWN Vandiver AL			13835eu
1300	1400		USA, KJES Vado NM		11715na	
1300	1400	Sat/Sun	USA, Voice of America		7575va	9510va
			9760va			
1300	1400	Sat/Sun	USA, WHRI Cypress Creek SC			9840na
1300	1400		USA, WINB Red Lion PA		9265ca	
1300	1400		USA, WJHR International Milton FL			15550usb
1300	1400		USA, WRMI Miami FL		9955ca	
1300	1400		USA, WTJC Newport NC		9370na	
1300	1400		USA, WTWW Lebanon TN		9480na	
1300	1400		USA, WWCR Nashville TN		7490af	9980na
			13845na	15825na		
1300	1400		USA, WWRB Manchester TN		9385na	
1300	1400		USA, WYFR/Family Radio Worldwide			7560as
			9310as	11520as	11560as	11830na
			11865na	11910na	17795na	
1300	1400		Zambia, 1 Africa Radio/CVC		6065af	13590af

1330	1400	mta	Guam, KSDA/ AWR	11860as		
1330	1400		India, All India Radio	9690as	11620as	
			13710as			
1330	1400		Laos, Lao National Radio	7145as		
1330	1400		Sweden, Radio Sweden	15735va		
1330	1400		Vietnam, Voice of Vietnam	9840as	12020as	

1400 UTC - 10AM EDT / 9AM CDT / 7AM PDT

1400	1415	Sun	Germany, Pan American Broadcasting	13645as		
1400	1425	mh	Guam, KTWR/TWR	9975as		
1400	1430		China, CNR-11/Holy Tibet	6010do	7350do	
			9480do			
1400	1430	`	Japan, NHK World/ Radio Japan	11705as		
			11985as	21560va		
1400	1430		Thailand, Radio Thailand World Service	9575va		
1400	1430	Sun	United Arab Emirates, FEBA Radio	12025as		
1400	1435	twfas	Guam, KTWR/TWR	9975as		
1400	1457		China, China Radio International	5955na		
			6075na	7300na	7325na	9460as
			9560as	9700as	9765va	9870as
			11665as	13675eu	13685eu	13740na
			15230af	17630af		
1400	1500		Anguilla, Worldwide Univ Network	11775am		
1400	1500		Australia, ABC NT Alice Springs	2310do		
1400	1500		Australia, ABC NT Katherine	2485do		
1400	1500		Australia, ABC NT Tennant Creek	2325do		
1400	1500		Australia, Radio Australia	5995pa	6080pa	
			7240pa	9590pa		
1400	1500		Bahrain, Radio Bahrain	6010me	9745al	
1400	1500	DRM	Belgium, TDP Radio/Disco Palace	6015eu		
1400	1500		Bhutan, Bhutan Broadcasting Service	6035as		
1400	1500	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1400	1500		Canada, CFRX Toronto ON	6070na		
1400	1500		Canada, CFVP Calgary AB	6030na		
1400	1500		Canada, CKZN St John's NF	6160na		
1400	1500		Canada, CKZU Vancouver BC	6160na		
1400	1500	Sat/Sun	Equatorial Guinea, Radio East Africa	15190af		
1400	1500		Germany, CVC Intl-Christian Vision	17770af		
1400	1500		India, All India Radio	9690as	11620as	
			13710as			
1400	1500		Libya, LJB/Voice of Africa	17725af	21695af	
1400	1500		Malaysia, RTM/Traxx FM	7295do		
1400	1500		Netherlands, R Netherlands Worldwide	11835as		
			15745as			
1400	1500		New Zealand, Radio NZ International	6170pa		
1400	1500		Nigeria, Voice of Nigeria/External Service			
			9690af			
1400	1500		Oman, Radio Oman	15140va		
1400	1500		Russia, Voice of Russia	4975va	6000as	
			9455as	11500as		
1400	1500	DRM	Russia, Voice of Russia	9750eu		
1400	1500		South Africa, Channel Africa	9625af		
1400	1500		Uganda, Radio Uganda	4975do		
1400	1500		UK, BBC World Service	5790eu	5875as	
			6190af	6195as	7230af	9740as
			11920as	12095as	15310as	17640af
			17830af	21470af		
1400	1500	DRM	UK, BBC World Service	9545eu	13590eu	
1400	1500	Sat	UK, Bible Voice Broadcasting	15265as		
1400	1500		United States, Overcomer Ministries	6110eu		
			13810va			
1400	1500		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1400	1500		USA, EWTN/WEWN Vandiver AL	13835as		
1400	1500		USA, KJES Vado NM	11715am		
1400	1500		USA, KNLS Anchor Point AK	11765as		
1400	1500		USA, Voice of America	6080af	12080af	
			15530va	15580af	17740va	17585af
1400	1500	mtwhf	USA, Voice of America	7540va	7575va	
			9760va			
1400	1500	Sat	USA, WBCQ Monticello ME	15420am		
1400	1500	Sat	USA, WHRI Cypress Creek SC	9840na		
1400	1500		USA, WINB Red Lion PA	9265ca		
1400	1500		USA, WJHR International Milton FL	15550usb		
1400	1500		USA, WRMI Miami FL	9955ca		
1400	1500		USA, WTJC Newport NC	9370na		
1400	1500		USA, WTWW Lebanon TN	9480na		
1400	1500		USA, WWCR Nashville TN	7490af	9980na	
			13845na	15825na		
1400	1500		USA, WWRB Manchester TN	9385na		
1400	1500		USA, WYFR/Family Radio Worldwide	6225as		
			9485as	9770as	11560na	11830na
			11910na	13695na	17795na	
1400	1500		Zambia, 1 Africa Radio/CVC	6065af	13590af	
1400	1557		China, China Radio International	5955as		
			6095as	7325as	7405as	9435na
			9870as	13685as	13740na	17630va
1415	1430		Germany, Pan American Broadcasting	13645as		
1415	1430		Nepal, Radio Nepal	5005as		
1415	1500	Sun	UK, Bible Voice Broadcasting	15265as		
1425	1455	mtwhf	Swaziland, TWR Africa	6065af		
1430	1445	Sun	Germany, Pan American Broadcasting	13645as		
1430	1500	mtwhfa	Albania, Radio Tirana	13625na		
1430	1500		Australia, Radio Australia	9475as	11660as	
1430	1500		China, CPBS/CNR Business Radio	6155do		
			7245do	7315as	7335as	7375as
			9820as	9775as		
1430	1500		Sweden, Radio Sweden	13820va		
1445	1500	mtwhf	Australia, FEBA Radio	15340as		
1445	1500	Sat/Sun	Australia, HCJB Global	15340as		

1500 UTC - 11AM EDT / 10AM CDT / 8AM PDT

1500	1510	mtwhfa	Turkmenistan, Turkmen Radiosi	5015eu		
1500	1515	Sun	UK, Bible Voice Broadcasting	13740as		
1500	1530		Australia, HCJB Global	15340as		
1500	1530	Sat/Sun	Clandestine, Sudan Radio Service/ SRS	17745af		
1500	1530		Guam, KSDA/ AWR	11720as		
1500	1530		UK, BBC World Service	7405af	11860af	
			15420af			
1500	1530		Vietnam, Voice of Vietnam	7285as	9840as	
			12020as			
1500	1545		USA, WYFR/Family Radio Worldwide	15770ca		
1500	1550		New Zealand, Radio NZ International	6170pa		
1500	1557		Canada, Radio Canada International	15125as		
			11975as			
1500	1557		China, China Radio International	5955as		
			6060as	6100as	7235as	7255as
			7420as	7435as	9435as	9525eu
			9570as	9600na	11650as	
1500	1557		Libya, LJB/Voice of Africa	17725af	21695af	
1500	1557		Netherlands, R Netherlands Worldwide	11835as		
			15745as			
1500	1557		North Korea, Voice of Korea	9335eu	11710na	
			13760na	15245eu		
1500	1600		Anguilla, Worldwide Univ Network	11775am		
1500	1600		Australia, ABC NT Alice Springs	2310do		
1500	1600		Australia, ABC NT Katherine	2485do		
1500	1600		Australia, Radio Australia	5995pa	6080pa	
			7240pa	9475as	9590pa	11660as
1500	1600		Bahrain, Radio Bahrain	6010me	9745al	
1500	1600	Sat/Sun	Canada, CBC NQ SW Service	9625na		
1500	1600		Canada, CFRX Toronto ON	6070na		
1500	1600		Canada, CFVP Calgary AB	6030na		
1500	1600		Canada, CKZN St John's NF	6160na		
1500	1600		Canada, CKZU Vancouver BC	6160na		
1500	1600	Sat/Sun	Equatorial Guinea, Radio East Africa	15190af		
1500	1600		Germany, CVC Intl-Christian Vision	17770af		
1500	1600		Malaysia, RTM/Traxx FM	7295do		
1500	1600		Myanmar, Myanma Radio	5985as		
1500	1600		Nigeria, Voice of Nigeria/External Service			
			15120af			
1500	1600		Russia, Voice of Russia	4975va	6000as	
			9455as	9660as	9735me	11985af
			12040eu	13855va		
1500	1600		South Africa, Channel Africa	9625af		
1500	1600		Uganda, Dunamis Shortwave	4750af		
1500	1600		Uganda, Radio Uganda	4975do		
1500	1600		UK, BBC World Service	5790eu	5875as	
			6575as	6190af	6195as	7230af
			9740as	11920as	12095eu	15310as
			15400af	17640af	17830af	21470af
1500	1600	DRM	UK, BBC World Service	5790eu	13590eu	
1500	1600		United States, Overcomer Ministries	6110eu		
			13810va	17485eu		
1500	1600		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1500	1600		USA, EWTN/WEWN Vandiver AL	13835as		
1500	1600		USA, Voice of America	4930af	7540va	
			7575va	12080af	12150va	13750va
			15530va	15580af	17895af	
1500	1600		USA, Voice of America/Special English	6140va		
			7520va	9485va	9760va	
1500	1600	Sat	USA, WBCQ Monticello ME	15420am		
1500	1600	Sat	USA, WHRI Cypress Creek SC	17510af		
1500	1600	Sun	USA, WHRI Cypress Creek SC	9840na		
1500	1600		USA, WINB Red Lion PA	13570ca		

1500	1600		USA, WJHR International Milton FL			15550usb
1500	1600		USA, WRMI Miami FL	9955na		
1500	1600		USA, WTJC Newport NC	9370na		
1500	1600		USA, WTWW Lebanon TN	9480na		
1500	1600		USA, WWCR Nashville TN	7490af	9980na	
			13845na	15825na		
1500	1600		USA, WWRB Manchester TN	9385na		
1500	1600		USA, WYFR/Family Radio Worldwide			6280as
			9495as	11830na	11910na	11985as
			12015as	17795na		
1500	1600		Zambia, 1 Africa Radio/CVC	6065af		13590af
1505	1600	DRM	Canada, Radio Canada International			9800na
1505	1600		Canada, Radio Canada International			9515as
1515	1530		Vatican City State, Vatican Radio			11850as
			13765as	15235as		
1515	1545	Sat	UK, Bible Voice Broadcasting	13740as		
1525	1600	Sat/Sun	Swaziland, TWR Africa	6025af		
1530	1558	Sat	Vatican City State, Vatican Radio			11850as
			13765as	15235as		
1530	1600		China, Xizang PBS/Holy Tibet	4905do		4920do
			5240do	6110do	6130do	6200do
			7255do	7385do		
1530	1600		Germany, AWR Europe	15255as		
1530	1600		Iran, VOIRI/IRIB	7305as	9600as	
1530	1600		Mongolia, Voice of Mongolia	12085as		
1530	1600		Sweden, Radio Sweden	13870va		13600al
1530	1600	h	UK, Bible Voice Broadcasting	13740as		
1530	1600	Sun	UK, Bible Voice Broadcasting	13590me		
1545	1600	m	UK, Bible Voice Broadcasting	13590me		
1545	1600	twhfa	UK, Bible Voice Broadcasting	13590me		
1551	1600		New Zealand, Radio NZ International			7440pa
1551	1600	DRM	New Zealand, Radio NZ International			6170pa

1600 UTC - 12PM EDT / 11AM CDT / 9AM PDT

1600	1605	Sun	Croatia, Croatian Radio	6165eu		
1600	1615	mtwhfa	Croatia, Croatian Radio	6165eu		
1600	1615		Pakistan, PBC/ Radio Pakistan	7530me		11565af
			11585af			
1600	1615	f	UK, Bible Voice Broadcasting	13590me		
1600	1625	Sat/Sun	Swaziland, TWR Africa	6025af		
1600	1627		Czech Republic, Radio Prague			9740eu
1600	1627		Iran, VOIRI/IRIB	7305as	9600as	
1600	1630	Sun	Germany, Pan American Broadcasting			11900as
1600	1630		Guam, KSDA/ AWR	11720as		11805as
1600	1630		Myanmar, Myanma Radio	9730do		
1600	1630		Vietnam, Voice of Vietnam	7220me		7280eu
			9550me	9730va		
1600	1645	h	UK, Bible Voice Broadcasting	13590me		
1600	1645		USA, WYFR/Family Radio Worldwide			11830na
			11865na			
1600	1657		North Korea, Voice of Korea	9990na		11545va
1600	1700		Anguilla, Worldwide Univ Network			11775am
1600	1700		Australia, ABC NT Alice Springs			2310do
1600	1700		Australia, ABC NT Katherine	2485do		
1600	1700		Australia, Radio Australia	5995pa		6080pa
			7240pa	9475as	9710pa	11660as
1600	1700		Bahrain, Radio Bahrain	6010me		9745al
1600	1700	Sat	Canada, CBC NQ SW Service	9625na		
1600	1700		Canada, CFRX Toronto ON	6070na		
1600	1700		Canada, CFVP Calgary AB	6030na		
1600	1700		Canada, CKZN St John's NF	6160na		
1600	1700		Canada, CKZU Vancouver BC	6160na		
1600	1700		Canada, Radio Canada International			9515as
1600	1700	DRM	Canada, Radio Canada International			9800na
1600	1700		Egypt, Radio Cairo	12170af		
1600	1700		Ethiopia, Radio Ethiopia/External Service			7165va
			9560af			
1600	1700	mtwhf	France, Radio France Internationale			15605af
			17605af			
1600	1700		Germany, CVC Intl-Christian Vision			17770af
1600	1700		Germany, Deutsche Welle	6170as		9485as
			9540as	15410as		
1600	1700		Malaysia, RTM/Traxx FM	7295do		
1600	1700		New Zealand, Radio NZ International			7440pa
1600	1700	DRM	New Zealand, Radio NZ International			6170pa
1600	1700		Russia, Voice of Russia	4975va		11985va
			12040eu	13855va		
1600	1700		South Korea, KBS World Radio			9515eu
1600	1700		Taiwan, Radio Taiwan International			11550as
			13840as			
1600	1700		Uganda, Dunamis Shortwave	4750af		
1600	1700		Uganda, Radio Uganda	4975do		
1600	1700		UK, BBC World Service	3255af		5790eu
			5850as	5975as	6190af	9695as
			12095eu	15400af	17640af	17795af
			17830af	21470af		
1600	1700	DRM	UK, BBC World Service	3995eu		5790eu
1600	1700	Sat/Sun	UK, Bible Voice Broadcasting	13590me		
1600	1700		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1600	1700		USA, EWTN/WEWN Vandiver AL			15610va
1600	1700		USA, Voice of America	4930af		6080af
			15580af			
1600	1700		USA, Voice of America/Special English			11890va
			12080va	13570va		
1600	1700	Sat	USA, WBCQ Monticello ME	15420am		
1600	1700	h	USA, WHRI Cypress Creek SC			17520af
1600	1700	Sat/Sun	USA, WHRI Cypress Creek SC			17520af
1600	1700	Sun	USA, WHRI Cypress Creek SC			9840na
1600	1700		USA, WINB Red Lion PA	13570ca		
1600	1700		USA, WJHR International Milton FL			15550usb
1600	1700		USA, WRMI Miami FL	9955na		
1600	1700		USA, WTJC Newport NC	9370na		
1600	1700		USA, WTWW Lebanon TN	9480na		
1600	1700		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1600	1700		USA, WWRB Manchester TN	9385na		
1600	1700		USA, WYFR/Family Radio Worldwide			5965me
			6085ca	11740as	11830af	13695na
			17795na	18980eu	21455eu	21525af
1600	1700		Zambia, 1 Africa Radio/CVC	6065af		13590af
1600	1757		China, China Radio International			6060af
			6100as	7235as	7255as	7420as
			7435as	9435as	9525eu	9570as
			9600eu	11650va		
1615	1630	mtwhf	Swaziland, TWR Africa	6130af		
1615	1630		Vatican City State, Vatican Radio			4005eu
			5885eu	7250eu	15595eu	
1615	1700	Sun	UK, BBC World Service	7405af		11860af
			15420af			
1630	1700		Guam, KSDA/ AWR	11740as		
1630	1700		Slovakia, Radio Slovakia International			5920eu
			6055eu			
1630	1700	Sat/Sun	Swaziland, TWR Africa	6130af		
1630	1700	Sat	UK, BBC World Service	11860af		
1630	1700	mtwhf	UK, BBC World Service	15420af		
1640	1650	mtwhfa	Turkmenistan, Turkmen Radiosi			4930eu

1700 UTC - 1PM EDT / 12PM CDT / 10AM PDT

1700	1705		Canada, Radio Canada International			9515as
1700	1705	DRM	Canada, Radio Canada International			9800na
1700	1715	mtwhf	Moldova, (Transnistria) Radio PMR			6240eu
1700	1715		UK, Bible Voice Broadcasting	13590me		
1700	1727		Czech Republic, Radio Prague			9740eu
1700	1730	DRM	Romania, Radio Romania International			7350eu
1700	1730		Sweden, Radio Sweden	13600va		13870va
1700	1730		USA, Voice of America	6080af		12015af
			15580af	17895af		
1700	1746		UK, BBC World Service	6005af		9410af
1700	1755		South Africa, Channel Africa	9675af		
1700	1756	DRM	Romania, Radio Romania International			9535eu
1700	1756		Romania, Radio Romania International			11735eu
1700	1757		China, China Radio International			6090af
			6100as	6140as	6165af	7205af
			7255af	7335as	7410eu	7420af
			7425eu	7435va	9570eu	
1700	1757		Netherlands, R Netherlands Worldwide			7395af
1700	1759		Canada, Radio Canada International			5850na
1700	1759		Poland, Polskie Radio Warsaw			7265eu
			9655eu			
1700	1800		Anguilla, Worldwide Univ Network			11775am
1700	1800		Australia, ABC NT Alice Springs			2310do
1700	1800		Australia, ABC NT Katherine	2485do		
1700	1800		Australia, Radio Australia	5995pa		6080pa
			9475as	9580pa	9710pa	11880pa
1700	1800		Bahrain, Radio Bahrain	6010me		9745al
1700	1800	Sat	Canada, CBC NQ SW Service	9625na		
1700	1800		Canada, CFRX Toronto ON	6070na		
1700	1800		Canada, CFVP Calgary AB	6030na		
1700	1800		Canada, CKZN St John's NF	6160na		
1700	1800		Canada, CKZU Vancouver BC	6160na		
1700	1800		Egypt, Radio Cairo	12170af		
1700	1800		Equatorial Guinea, Radio Africa			7190af
			15190af			
1700	1800		Germany, CVC Intl-Christian Vision			17770af
1700	1800	DRM	Germany, Deutsche Welle	5790eu		
1700	1800		Kuwait, Radio Kuwait	11990va		
1700	1800		Malaysia, RTM/Traxx FM	7295do		
1700	1800		New Zealand, Radio NZ International			7440pa

1700	1800	DRM	New Zealand, Radio NZ International			6170pa
1700	1800		Nigeria, Voice of Nigeria/External Service			
			15120af			
1700	1800		Russia, Voice of Russia	4975va		11985va
			12040eu	13855af		
1700	1800		Swaziland, TWR Africa	3200af		9500af
1700	1800		Taiwan, Radio Taiwan International			15690af
1700	1800		Tajikistan, Voice of Tajik/External Svc			7245va
1700	1800		Uganda, Dunamis Shortwave	4750af		
1700	1800		Uganda, Radio Uganda	4975do		
1700	1800		UK, BBC World Service	3255af		5790eu
			5850as	5875eu	5975as	6190af
			7405af	9810as	12095af	13675eu
			15400af	17795af	17830af	
1700	1800	DRM	UK, BBC World Service	3995eu		
1700	1800	Sat	UK, Bible Voice Broadcasting	9645me		
1700	1800	Sat/Sun	UK, Bible Voice Broadcasting	13590me		
1700	1800		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1700	1800		USA, EWTN/WEWN Vandiver AL			15610va
1700	1800		USA, WBCQ Monticello ME	15420am		
1700	1800		USA, WHRI Cypress Creek SC			9840na
1700	1800	Sat/Sun	USA, WHRI Cypress Creek SC			17520af
1700	1800		USA, WINB Red Lion PA	13570ca		
1700	1800		USA, WJHR International Milton FL			15550usb
1700	1800		USA, WRMI Miami FL	9955ca		
1700	1800		USA, WTJC Newport NC	9370na		
1700	1800		USA, WTWW Lebanon TN	9480na		
1700	1800		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1700	1800		USA, WWRB Manchester TN	9385na		
1700	1800		USA, WYFR/Family Radio Worldwide			12020as
			12045af	13690na	17795na	18980eu
			21455eu	21680af		
1700	1800		Zambia, 1 Africa Radio/CVC	4965af		13590af
1730	1740	fas	USA, Voice of America	4930af		11605af
			15775af			
1730	1800		Bulgaria, Radio Bulgaria	5900eu		7400eu
1730	1800	DRM	Bulgaria, Radio Bulgaria	9400eu		
1730	1800		Clandestine, Sudan Radio Service/ SRS			9840af
1730	1800		UK, Bible Voice Broadcasting	13590me		
1730	1800	Sun	UK, Bible Voice Broadcasting	9645me		
1730	1800		USA, Voice of America	12015af		15580af
			17895af			
1730	1800		Vatican City State, Vatican Radio			11625af
			13765af	15570af		
1745	1800		Bangladesh, Bangladesh Betar			7250as
1745	1800	DRM	India, All India Radio	9950eu		
1745	1800		India, All India Radio	6120af		6280eu
			7400af	7410af	7550eu	9415af
			9445af	11935af		
1745	1800	mtwhf	Moldova, (Transnistria) Radio PMR			6240na
1755	1800		Clandestine, Radio Dialogue	4895af		

1800 UTC - 2PM EDT / 1PM CDT / 11AM PDT

1800	1810	Sun	UK, Bible Voice Broadcasting	13590me		
1800	1815		Clandestine, Radio Dialogue	4895af		
1800	1827		China, China Radio International			6020eu
1800	1830	w	Austria, AWR Europe	9755af		
1800	1830		South Africa, AWR 3215af	3345af		9610af
1800	1830		UK, BBC World Service	5850as		5975as
1800	1830	Sun	UK, Bible Voice Broadcasting	9430me		
1800	1830		USA, Voice of America	6080af		9850af
			12015af	15580af		
1800	1830	fa	USA, Voice of America	4930af		11605af
			15775af			
1800	1830		Vietnam, Voice of Vietnam	5955eu		
1800	1835		New Zealand, Radio NZ International			7440pa
1800	1835	DRM	New Zealand, Radio NZ International			6170pa
1800	1857		China, China Radio International			6100eu
			7265eu	7405eu		
1800	1857		Netherlands, R Netherlands Worldwide			6020af
1800	1857		North Korea, Voice of Korea	13760af		15245eu
1800	1859		Canada, Radio Canada International			9530af
			11765af	17735af	17810af	
1800	1900		Anguilla, Worldwide Univ Network			11775am
1800	1900	mtwhf	Argentina, Radio Nacional RAE			9690eu
			15345eu			
1800	1900		Australia, ABC NT Alice Springs			2310do
1800	1900		Australia, ABC NT Katherine	2485do		
1800	1900		Australia, Radio Australia	6080pa		7240pa
			9475as	9580pa	9710pa	11880pa
1800	1900		Bahrain, Radio Bahrain	6010me		9745al
1800	1900		Bangladesh, Bangladesh Betar			7250eu
1800	1900		Canada, CFRX Toronto ON	6070na		
1800	1900		Canada, CFVP Calgary AB	6030na		
1800	1900		Canada, CKZN St John's NF	6160na		
1800	1900		Canada, CKZU Vancouver BC	6160na		
1800	1900		Equatorial Guinea, Radio Africa			7190af
			15190af			
1800	1900		Germany, CVC Intl-Christian Vision			17770af
1800	1900	DRM	Germany, Deutsche Welle	5790eu		
1800	1900	DRM	India, All India Radio	9950eu		
1800	1900		India, All India Radio	6120af		6280eu
			7400af	7410af	7550eu	9415af
			9445af	11935af		
1800	1900		Kuwait, Radio Kuwait	11990va		
1800	1900		Malaysia, RTM/Traxx FM	7295do		
1800	1900		Netherlands, R Netherlands Worldwide			12045af
			15535af			
1800	1900		Nigeria, Voice of Nigeria/External Service			
			15120af	7255al		
1800	1900	DRM	Poland, Polskie Radio Warsaw			6130eu
1800	1900		Russia, Voice of Russia	4975me		
1800	1900		South Korea, KBS World Radio			7275eu
1800	1900		Swaziland, TWR Africa	3200af		9500af
1800	1900		Taiwan, Radio Taiwan International			6155eu
1800	1900		Uganda, Dunamis Shortwave	4750af		
1800	1900		Uganda, Radio Uganda	4975do		
1800	1900		UK, BBC World Service	3255af		5790eu
			5875eu	5950as	6190af	7405af
			9485as	11810af	12095af	13675eu
			15400af	17795af		
1800	1900	Sat	UK, Bible Voice Broadcasting	9430me		
1800	1900	Sun	UK, Bible Voice Broadcasting	6130eu		
1800	1900		USA, American Forces Network			4319usb
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1800	1900		USA, EWTN/WEWN Vandiver AL			15610va
1800	1900		USA, KJES Vado NM	15385pa		
1800	1900		USA, WBCQ Monticello ME	15420am		
1800	1900	mtwhf	USA, WBCQ Monticello ME	9330am		
1800	1900	smtwhf	USA, WBCQ Monticello ME	7415am		
1800	1900	hfas	USA, WHRI Cypress Creek SC			9840na
1800	1900	Sun	USA, WHRI Cypress Creek SC			17520af
1800	1900		USA, WINB Red Lion PA	13570ca		
1800	1900		USA, WJHR International Milton FL			15550usb
1800	1900		USA, WRMI Miami FL	9955ca		
1800	1900		USA, WTJC Newport NC	9370na		
1800	1900		USA, WTWW Lebanon TN	9480na		
1800	1900		USA, WWCR Nashville TN	9980na		12160af
			13845na	15825na		
1800	1900		USA, WWRB Manchester TN	9385na		
1800	1900		USA, WYFR/Family Radio Worldwide			5840af
			6180af	7395af	9770af	9895na
			13615na	13690na	17795af	17845eu
			18980eu			
1800	1900		Zambia, 1 Africa Radio/CVC	4965af		13590af
1805	1810	Sat	Croatia, Croatian Radio	6165eu		
1805	1815	mtwhf	Croatia, Croatian Radio	6165eu		
1830	1845		Rwanda, Radio Rwanda	6055do		
1830	1845	Sat	UK, Bible Voice Broadcasting	6130eu		
1830	1900		Serbia, International Radio of Serbia			6100eu
1830	1900		Slovakia, Radio Slovakia International			5920eu
			6055eu			
1830	1900		Turkey, Voice of Turkey	9785eu		
1830	1900		UK, BBC World Service	6005af		9410af
1830	1900	f	UK, Bible Voice Broadcasting	9430me		
1830	1900		USA, Voice of America	4930af		6080af
			9850af	12015af	15580af	
1836	1900		New Zealand, Radio NZ International			9615pa
1836	1900	DRM	New Zealand, Radio NZ International			9890pa
1845	1900	mtwhas	Albania, Radio Tirana	7520eu		13640na
1845	1900	Sun	UK, Bible Voice Broadcasting	11830af		
1859	1900		Netherlands, R Netherlands Worldwide			7425af
			11610af	11970af		

1900 UTC - 3PM EDT / 2PM CDT / 12PM PDT

1900	1915	Sun	UK, Bible Voice Broadcasting	11830af		
1900	1930		Germany, Deutsche Welle	6150af		11795af
			17865af			
1900	1930		Turkey, Voice of Turkey	9785eu		
1900	1930		USA, Voice of America	4930af		4940af
			6080af	9850af	15580af	17895af
1900	1930		Vietnam, Voice of Vietnam	7280eu		9730eu
1900	1935	DRM	New Zealand, Radio NZ International			9890pa
1900	1945	DRM	India, All India Radio	9950eu		

1900	1945		India, All India Radio	6120af	6280eu	
			7400af	7410af	7550eu	9415af
			9445af	11935af		
1900	1945	mtwh	USA, WBCQ Monticello ME	7415am		
1900	1945		USA, WYFR/Family Radio Worldwide	6085ca		
1900	1950		New Zealand, Radio NZ International	9615pa		
1900	1957		China, China Radio International	7285eu		
			7295va	9440va		
1900	1957		Netherlands, R Netherlands Worldwide	7425af		
			12045af	15535af		
1900	1957		North Korea, Voice of Korea	7100eu	9975af	
			11535va	11910af		
1900	2000		Anguilla, Worldwide Univ Network	11775am		
1900	2000		Australia, ABC NT Alice Springs	2310do		
1900	2000		Australia, ABC NT Katherine	2485do		
1900	2000		Australia, Radio Australia	6080pa	7240pa	
			9500as	9580pa	9710pa	11880pa
1900	2000		Bahrain, Radio Bahrain	6010me	9745al	
1900	2000	DRM	Belgium, TDP Radio	15755na		
1900	2000		Canada, CFRX Toronto ON	6070na		
1900	2000		Canada, CFVP Calgary AB	6030na		
1900	2000		Canada, CKZN St John's NF	6160na		
1900	2000		Canada, CKZU Vancouver BC	6160na		
1900	2000		Egypt, Radio Cairo	11510af		
1900	2000		Equatorial Guinea, Radio Africa	7190af		
			15190af			
1900	2000		Germany, CVC Intl-Christian Vision	17770af		
1900	2000	DRM	Germany, Deutsche Welle	3995eu	5875eu	
1900	2000		Kuwait, Radio Kuwait	11990va		
1900	2000		Malaysia, RTM/Traxx FM	7295do		
1900	2000		Netherlands, R Netherlands Worldwide	11610af		
			11970af			
1900	2000		Nigeria, Voice of Nigeria/External Service			
			15120af			
1900	2000		Russia, Voice of Russia	12040eu		
1900	2000	mtwhf	Spain, Radio Exterior de Espana	9665af		
			11620eu			
1900	2000		Swaziland, TWR Africa	3200af		
1900	2000		Thailand, Radio Thailand World Service	7570eu		
1900	2000		Uganda, Radio Uganda	4975do		
1900	2000		UK, BBC World Service	3255af	3995eu	
			5875eu	5950as	6005af	6155as
			6190af	9410af	11810af	12095af
			15400af	17795af		
1900	2000		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
1900	2000		USA, EWTN/WEWN Vandiver AL	15610va		
1900	2000		USA, Voice of America/Special English	7485va		
			9630va			
1900	2000	fas	USA, WBCQ Monticello ME	7415am		
1900	2000		USA, WBCQ Monticello ME	15420am		
1900	2000	mtwhfa	USA, WHRI Cypress Creek SC	9840na		
1900	2000	Sun	USA, WHRI Cypress Creek SC	15665af		
1900	2000		USA, WINB Red Lion PA	13570ca		
1900	2000		USA, WJHR International Milton FL	15550usb		
1900	2000		USA, WRMI Miami FL	9955ca		
1900	2000		USA, WTJC Newport NC	9370na		
1900	2000		USA, WTWW Lebanon TN	9480na		
1900	2000		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
1900	2000		USA, WWRB Manchester TN	9385na		
1900	2000		USA, WYFR/Family Radio Worldwide	3230af		
			6020af	7395af	9480af	9490af
			9885af	13615na	13690na	17795na
			17845af	18930eu	18980eu	
1900	2000		Zambia, 1 Africa Radio/CVC	4965af	5940af	
1905	1920	Sat	Mali, ORTM Du Mali	5995do		
1905	2000	m	South Africa, Radio League	3215af		
1930	2000	Sun	Germany, Pan American Broadcasting	6020af		
1930	2000		Iran, VOIRI/IRIB	5945eu	6205eu	7205eu
			7215af	9800af		
1930	2000		South Africa, RTE Radio One	6225af		
1930	2000		USA, Voice of America	4930af	4940af	
			6080af	9850af	15580af	
1936	2000	DRM	New Zealand, Radio NZ International	11675pa		
1945	2000	DRM	Vatican City State, Vatican Radio	9800am		
1950	2000		Vatican City State, Vatican Radio	4005eu		
			5885eu	7250eu	9645eu	
1951	2000		New Zealand, Radio NZ International	11725pa		

2000 UTC - 4PM EDT / 3PM CDT / 1PM PDT

2000	2005	m	South Africa, Radio League	3215af		
2000	2015	Sun	Germany, Pan American Broadcasting	6020af		
2000	2020		Vatican City State, Vatican Radio	4005eu		
			5885eu	7250eu	9645eu	
2000	2027		Czech Republic, Radio Prague	5930eu		
2000	2027		Iran, VOIRI/IRIB	5945eu	6205eu	7205eu
			7215af	9800af		
2000	2030	mtwhfa	Albania, Radio Tirana	7465eu	13640na	
2000	2030		Egypt, Radio Cairo	11510af		
2000	2030	Sat	Germany, Pan American Broadcasting	6020af		
2000	2030		South Africa, RTE Radio One	6225af		
2000	2030		Swaziland, TWR Africa	3200af		
2000	2030		USA, Voice of America	4930af	4940af	
			6080af	15580af		
2000	2030	DRM	Vatican City State, Vatican Radio	9800am		
2000	2030		Vatican City State, Vatican Radio	7365af		
			9755af	11625af		
2000	2045	h	Rwanda, Radio Rwanda	6055do		
2000	2045		USA, WYFR/Family Radio Worldwide	17750eu		
2000	2050	DRM	New Zealand, Radio NZ International	11675pa		
2000	2057		China, China Radio International	5960eu		
			5985af	7415va	7285eu	7295eu
			9440eu	9600af	11640af	13630af
2000	2057		Germany, Deutsche Welle	6150af	11795af	
			11865af			
2000	2057		Netherlands, R Netherlands Worldwide	7425af		
			11610af	11970af		
2000	2059		Canada, Radio Canada International	15235af		
			17735af			
2000	2100		Anguilla, Worldwide Univ Network	11775am		
2000	2100		Australia, ABC NT Alice Springs	2310do		
2000	2100		Australia, ABC NT Katherine	2485do		
2000	2100		Australia, ABC NT Tennant Creek	2325do		
2000	2100		Australia, Radio Australia	9500as	11650pa	
			11660pa	11880pa		
2000	2100	Sat/Sun	Australia, Radio Australia	6080pa	7240pa	
			12080pa			
2000	2100		Bahrain, Radio Bahrain	6010me	9745al	
2000	2100		Belarus, Radio Belarus	7255eu	7360eu	
			7390eu			
2000	2100	DRM	Belgium, TDP Radio/Disco Palace	17755na		
2000	2100		Canada, CFRX Toronto ON	6070na		
2000	2100		Canada, CFVP Calgary AB	6030na		
2000	2100		Canada, CKZN St John's NF	6160na		
2000	2100		Canada, CKZU Vancouver BC	6160na		
2000	2100		Equatorial Guinea, Radio Africa	7190af		
			15190af			
2000	2100		Germany, CVC Intl-Christian Vision	17770af		
2000	2100		Indonesia, Voice of Indonesia	9526va	11785al	
2000	2100		Kuwait, Radio Kuwait	11990va		
2000	2100		Malaysia, RTM/Traxx FM	7295do		
2000	2100		New Zealand, Radio NZ International	11725pa		
2000	2100		Nigeria, Voice of Nigeria/External Service			
			15120af			
2000	2100		Russia, Voice of Russia	12040eu		
2000	2100		Uganda, Radio Uganda	4975do		
2000	2100		UK, BBC World Service	3255af	5875eu	
			6005af	6190af	9410af	11810af
			12095af	13820af	15400af	
2000	2100		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2000	2100		USA, EWTN/WEWN Vandiver AL	15610va		
2000	2100	fas	USA, WBCQ Monticello ME	7415am		
2000	2100		USA, WBCQ Monticello ME	15420am		
2000	2100	Sat	USA, WHRI Cypress Creek SC	15665af		
2000	2100		USA, WINB Red Lion PA	13570ca		
2000	2100		USA, WJHR International Milton FL	15550usb		
2000	2100		USA, WRMI Miami FL	9955ca		
2000	2100		USA, WTJC Newport NC	9370na		
2000	2100		USA, WTWW Lebanon TN	9480na		
2000	2100		USA, WWCR Nashville TN	9980na	12160af	
			13845na	15825na		
2000	2100		USA, WWRB Manchester TN	9385na		
2000	2100		USA, WYFR/Family Radio Worldwide	6020af		
			6260eu	7240eu	9480af	9610af
			15195af	17725ca	17795na	17845af
			18980na			
2000	2100		Zambia, 1 Africa Radio/CVC	4965af	5940af	
2000	2105		Uganda, Radio Uganda	4975do		
2030	2045		Thailand, Radio Thailand World Service	9680eu		
2030	2056		Romania, Radio Romania International	9690na		
			11880eu	11940na		
2030	2056	DRM	Romania, Radio Romania International	9765eu		
2030	2100		Cuba, Radio Havana Cuba	11760ca		
2030	2100		Sweden, Radio Sweden	9495va		
2030	2100		Turkey, Voice of Turkey	7205va		

2030	2100		USA, Voice of America	4930af	6080af	
			7355af	15580af		
2030	2100	fa	USA, Voice of America	4940af		
2030	2100		Vietnam, Voice of Vietnam	7220me	7280eu	
			9550me	9730eu		
2045	2100		India, All India Radio	6280eu	7550eu	
			9445eu	9910pa	11620pa	11715pa
2045	2100	DRM	India, All India Radio	9950eu		

2100 UTC - 5PM EDT / 4PM CDT / 2PM PDT

2100	2127		China, China Radio International	7250af		
			11640af	13630af		
2100	2130		Australia, ABC NT Alice Springs	2310do		
2100	2130		Australia, ABC NT Alice Springs	2310do		
2100	2130		Australia, ABC NT Katherine	2485do		
2100	2130		Australia, ABC NT Tennant Creek	2325do		
2100	2130		Austria, AWR Europe	11955af		
2100	2130	Sat	Canada, CBC NQ SW Service	9625na		
2100	2130		Cuba, Radio Havana Cuba	11760ca		
2100	2130		Serbia, International Radio of Serbia	6100eu		
2100	2130		South Korea, KBS World Radio	3955eu		
2100	2130		Turkey, Voice of Turkey	7205va		
2100	2145		USA, WYFR/Family Radio Worldwide	13615na		
			13690na	17795na	18980na	
2100	2150		New Zealand, Radio NZ International	11725pa		
2100	2150	DRM	New Zealand, Radio NZ International	11675pa		
2100	2157		China, China Radio International	5960eu		
			6135af	7205eu	7225af	7325af
			7405af	7415af	9600af	
2100	2157		Germany, Deutsche Welle	9735as	11865af	
			15640af			
2100	2157		North Korea, Voice of Korea	13760va	15245eu	
2100	2200		Angola, Radio Nacional de Angola	7217do		
2100	2200		Anguilla, Worldwide Univ Network	11775am		
2100	2200		Australia, Radio Australia	9500as	9660pa	
			11695as	12080pa	13630pa	15515pa
2100	2200		Bahrain, Radio Bahrain	6010me	9745al	
2100	2200		Belarus, Radio Belarus	7255eu	7360as	
			7390eu			
2100	2200		Bulgaria, Radio Bulgaria	5900eu	7400eu	
2100	2200		Canada, CFRX Toronto ON	6070na		
2100	2200		Canada, CFVP Calgary AB	6030na		
2100	2200		Canada, CKZN St John's NF	6160na		
2100	2200		Canada, CKZU Vancouver BC	6160na		
2100	2200	DRM	Canada, Radio Canada International	9800na		
2100	2200		Equatorial Guinea, Radio Africa	7190af		
			15190af			
2100	2200		India, All India Radio	6280eu	7550eu	
			9445eu	9910pa	11620pa	11715pa
2100	2200	DRM	India, All India Radio	9950eu		
2100	2200		Malaysia, RTM/Traxx FM	7295do		
2100	2200	Sat/Sun	Spain, Radio Exterior de Espana	9650eu		
2100	2200		Syria, Radio Damascus	9330eu	12085as	
2100	2200	DRM	UK, BBC World Service	3995eu		
2100	2200		UK, BBC World Service	3255af	3915as	
			5790eu	5875as	5905as	6005af
			6190af	6195as	7405af	9915af
			12095af			
2100	2200		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2100	2200		USA, EWTN/WEWN Vandiver AL	15610va		
2100	2200		USA, Voice of America	6080af	15580af	
2100	2200	stwhf	USA, WBCQ Monticello ME	5110am		
2100	2200	Sat	USA, WHRI Cypress Creek SC	13660af		
2100	2200	Sun	USA, WHRI Cypress Creek SC	9690na		
2100	2200		USA, WINB Red Lion PA	13570ca		
2100	2200		USA, WJHR International Milton FL	15550usb		
2100	2200		USA, WRMI Miami FL	9955ca		
2100	2200		USA, WTJC Newport NC	9370na		
2100	2200		USA, WTWW Lebanon TN	9480na		
2100	2200		USA, WWCR Nashville TN	7465na	9350na	
			9980na	13845na		
2100	2200		USA, WWRB Manchester TN	3215na		
2100	2200		USA, WYFR/Family Radio Worldwide	6240eu		
			9480af	15195af	17845af	
2100	2200		Zambia, 1 Africa Radio/CVC	4965af	5940af	
2115	2200		Egypt, Radio Cairo	6270eu		
2130	2157		Czech Republic, Radio Prague	9410af		
2130	2200		Australia, ABC NT Alice Springs	4835do		
2130	2200		Australia, ABC NT Katherine	5025do		
2130	2200	mtwhfa	Canada, CBC NQ SW Service	9625na		
2130	2200		China, China Radio International	7365eu		
			7415as			
2130	2200		Guam, KSDA/ AWR	11850as		
2130	2200		Netherlands, R Netherlands Worldwide	7460af		
2130	2200		Sweden, Radio Sweden	7460va		

2200 UTC - 6PM EDT / 5PM CDT / 3PM PDT

2200	2230		India, All India Radio	6280eu	7550eu	
			9445eu	9910pa	11620pa	11715pa
2200	2230	DRM	India, All India Radio	9950eu		
2200	2245		Egypt, Radio Cairo	6270eu		
2200	2245		USA, WYFR/Family Radio Worldwide	15770af		
2200	2256		Romania, Radio Romania International	5960as		
			7435va	9790eu	11940as	
2200	2257		China, China Radio International	5915na		
2200	2300		Anguilla, Worldwide Univ Network	6090am		
2200	2300		Australia, ABC NT Alice Springs	4835do		
2200	2300		Australia, ABC NT Katherine	5025do		
2200	2300		Australia, Radio Australia	9660pa	12010as	
			12040as	13630pa	15230pa	15240as
			15515pa	15560pa		
2200	2300		Bahrain, Radio Bahrain	6010me	9745al	
2200	2300	smtwhf	Canada, CBC NQ SW Service	9625na		
2200	2300		Canada, CFRX Toronto ON	6070na		
2200	2300		Canada, CFVP Calgary AB	6030na		
2200	2300		Canada, CKZN St John's NF	6160na		
2200	2300		Canada, CKZU Vancouver BC	6160na		
2200	2300		Equatorial Guinea, Radio Africa	7190af		
			15190af			
2200	2300		Malaysia, RTM/Traxx FM	7295do		
2200	2300		New Zealand, Radio NZ International	13730pa		
2200	2300	DRM	New Zealand, Radio NZ International	15720pa		
2200	2300		Russia, Voice of Russia	9890na		
2200	2300		Turkey, Voice of Turkey	9830va		
2200	2300		Uganda, Radio Uganda	4975do		
2200	2300		UK, BBC World Service	3915as	5905as	
			5935af	6195as	7490as	9440as
			9740as	9915af	12095af	
2200	2300	DRM	UK, BBC World Service	3995eu		
2200	2300		USA, American Forces Network	4319usb		
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2200	2300		USA, EWTN/WEWN Vandiver AL	15610va		
2200	2300	mtwhf	USA, Voice of America	5895va	7460va	
			7575va	11955va		
2200	2300	mtwhf	USA, WBCQ Monticello ME	7415am		
2200	2300	Sat/Sun	USA, WBCQ Monticello ME	5110am		
2200	2300	f	USA, WHRI Cypress Creek SC	11785na		
2200	2300	Sun	USA, WHRI Cypress Creek SC	9785af		
2200	2300		USA, WINB Red Lion PA	9265ca		
2200	2300		USA, WJHR International Milton FL	15550usb		
2200	2300		USA, WRMI Miami FL	9955ca		
2200	2300		USA, WTJC Newport NC	9370na		
2200	2300		USA, WTWW Lebanon TN	9480na		
2200	2300		USA, WWCR Nashville TN	7465na	9350na	
			9980na	13845na		
2200	2300		USA, WWRB Manchester TN	3215na	6890va	
2200	2300		USA, WYFR/Family Radio Worldwide	5950na		
			11740na	15440na		
2200	2300		Zambia, 1 Africa Radio/CVC	4965af		
2215	2230		Croatia, Croatian Radio	3985eu	7375ca	
2230	2257		Czech Republic, Radio Prague	9440na		
2230	2300		China, Xizang PBS/Holy Tibet	4905do	4920do	
			5240do	6110do	6130do	6200do
			7255do	7385do		
2230	2300		Guam, KSDA/ AWR	15320as		
2230	2300		USA, Voice of America/Special English	9570va		
			11705va	15145va		
2245	2300		India, All India Radio	6055as	7305as	
			9705as	9705as	9950as	11645as
			13605as			

2300 UTC - 7PM EDT / 6PM CDT / 4PM PDT

2300	0000		Anguilla, Worldwide Univ Network	6090am		
2300	0000		Australia, ABC NT Alice Springs	4835do		
2300	0000		Australia, ABC NT Katherine	5025do		
2300	0000		Australia, Radio Australia	9660pa	12010as	
			12040as	13690pa	15230pa	15560pa
			17796pa			
2300	0000		Bahrain, Radio Bahrain	6010me	9745al	
2300	0000		Bulgaria, Radio Bulgaria	9700na	11700na	
2300	0000	smtwhf	Canada, CBC NQ SW Service	9625na		
2300	0000		Canada, CFRX Toronto ON	6070na		
2300	0000		Canada, CFVP Calgary AB	6030na		
2300	0000		Canada, CKZN St John's NF	6160na		
2300	0000		Canada, CKZU Vancouver BC	6160na		

2300	0000		Cuba, Radio Havana Cuba	5040na		
2300	0000		Egypt, Radio Cairo	11590na		
2300	0000		India, All India Radio	6055as	7305as	
			9705as	9705as	9950as	11645as
			13605as			
2300	0000		Malaysia, RTM/Traxx FM	7295do		
2300	0000		New Zealand, Radio NZ International		13730pa	
2300	0000	DRM	New Zealand, Radio NZ International		15720pa	
2300	0000		Russia, Voice of Russia	9665na	9890na	
2300	0000		UK, BBC World Service	3915as	6195as	
			7490as	9740as	9890as	11850as
			12010as			
2300	0000		USA, American Forces Network		4319usb	
			5446usb	5765usb	7812usb	12133usb
			12759usb	13362usb		
2300	0000		USA, EWTN/WEWN Vandiver AL		15610va	
2300	0000		USA, Voice of America	5895va	7575va	
			11955va			
2300	0000	h	USA, WBCQ Monticello ME	7415am		
2300	0000	Sat/Sun	USA, WBCQ Monticello ME	5110am		
2300	0000	fas	USA, WHRI Cypress Creek SC		5920ca	
2300	0000	Sat	USA, WHRI Cypress Creek SC		9620na	
2300	0000		USA, WINB Red Lion PA	9265ca		
2300	0000		USA, WJHR International Milton FL		15550usb	
2300	0000		USA, WRMI Miami FL	9955ca		
2300	0000		USA, WTJC Newport NC	9370na		
2300	0000		USA, WTWW Lebanon TN	9480na		
2300	0000		USA, WWCR Nashville TN	7465na	9350na	
			9980na	13845na		
2300	0000		USA, WWRB Manchester TN	3215na	6890va	
2300	0000		USA, WYFR/Family Radio Worldwide		5950na	
			11580ca	15255ca	15440na	
2300	0000		Zambia, 1 Africa Radio/CVC	4965af		
2300	2330		Australia, Radio Australia	15240as		
2300	2330		USA, Voice of America/Special English		9570as	
			13755va	15145va		
2300	2330	DRM	Vatican City State, Vatican Radio		9755am	
2300	2345		USA, WYFR/Family Radio Worldwide		11740na	
2300	2357		China, China Radio International		5915as	
			5990na	6040na	6145na	7350as
			7415as	9610as	11790va	11970va
2330	0000		Australia, Radio Australia	15415as	17750as	
2330	0000		UK, BBC World Service	9580as		
2330	0000		USA, Voice of America/Special English		7460as	
			9570va	13755va	15145va	15340va
2330	0000		Vietnam, Voice of Vietnam	9840as	12020as	

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Angola, Radio Nacional de Angola.....**www.rna.ao/**
Anguilla, Worldwide Univ Network .....**www.worldwideuniversitynetwork.com/**
Argentina, Radio Nacional RAE.....**www.radionacional.com.ar/**
Australia, ABC NT Alice Springs.....**www.abc.net.au/radio/**
Australia, ABC NT Katherine.....**www.abc.net.au/radio/**
Australia, ABC NT Tennant Creek .....**www.abc.net.au/radio/**
Australia, FEBA Radio.....**www.feba.org**
Australia, HCJB Global .....**www.hcjb.org/**
Australia, Radio Australia .....**www.abc.net.au/ra/**
Austria, AWR Europe **www.awr2.org/**
Bahrain, Radio Bahrain .....**www.radiobahrain.fm/**
Bangladesh, Bangladesh Betar .....**www.betar.org.bd/**
Belarus, Radio Belarus .....**www.radiobelarus.tvr.by/eng/**
Belgium, TDP Radio .....**www.airtime.be/schedule.html**
Belgium, TDP Radio/Disco Palace .....**www.airtime.be/schedule.html**
Bhutan, Bhutan Broadcasting Service .....**www.bbs.com.bt/**
Bulgaria, Radio Bulgaria .....**www.bnr.bg/**
Canada, CBC NQ SW Service.....**www.cbc.ca/north/**
Canada, CFRX Toronto ON.....**www.cfrb.com**
Canada, CFVP Calgary AB.....**www.classiccountryam1060.com**
Canada, CKZN St John's NF .....**www.cbc.ca/listen/index.html**
Canada, CKZU Vancouver BC.....**www.cbc.ca/bc**
Canada, Radio Canada International .....**www.rcinet.ca/**
China, China Radio International .....**www.cri.cn/**
China, Guangxi FBS/Beibu Bay Radio .....**www.gxradio.com/index/index.asp**
China, Voice of the Strait.....**www.vos.com.cn**
Clandestine, Cotton Tree News.....**www.cottontreenews.org/**
Clandestine, Sudan Radio Service/ SRS ....**www.sudanradio.org/**
Croatia, Croatian Radio .....**www.hrt.hr/**
Cuba, Radio Havana Cuba .....**www.radiohc.cu/**
Czech Republic, Radio Prague .....**www.radio.cz/**
Egypt, Radio Cairo.....**www.sis.gov.eg/**
Ethiopia, Radio Ethiopia/External Service..**www.erta.gov.et**
France, Radio France Internationale.....**http://rfienglish.com**
Germany, AWR Europe.....**www.awr2.org/**
Germany, Blue Star Radio .....**www.mvbalticradio.de**
Germany, CVC Intl-Christian Vision .....**www.christianvision.com/**
Germany, Deutsche Welle .....**www.dw-world.de/**
Germany, European Music Radio.....**www.emr.org.uk/**
Germany, Pan American Broadcasting .....**www.radiopanam.com/**
Germany, Radio Gloria International .....**www.radiopanam.com/**
Germany, TWR Europe.....**www.twr.org**
Greece, Voice of Greece .....**www.voiceofgreece.gr/**
Guam, KSDA/ AWR **www.awr2.org/**
Guam, KTWR/TWR.....**www.twr.org/**
India, All India Radio .....**www.allindiaradio.org/**
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Iran, VOIRI/IRIB .....**www.irib.ir/English/**
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Kuwait, Radio Kuwait.....**www.media.gov.kw/**
Laos, Lao National Radio .....**www.lnr.org.la**
Libya, LJB/Voice of Africa .....**www.voiceofafrica.com.ly**
Malaysia, RTM/Traxx FM.....**www.traxxfm.net/index.php**
Malaysia, RTM/Voice of Malaysia.....**www.rtm.gov.my**
Mali, ORTM Du Mali .....**www.ortm.ml**
Monaco, TWR Europe .....**www.twr.org/**
Mongolia, Voice of Mongolia.....**www.mnb.mn**
Nepal, Radio Nepal .....**www.radionepal.org/**
Netherlands, R Netherlands Worldwide ....**www.radionepal.org/**
New Zealand, Radio NZ International .....**www.rnzi.com**
Nigeria, Voice of Nigeria/External Service **www.voiceofnigeria.org**
Oman, Radio Oman.....**www.oman-tv.gov.om**
Pakistan, PBC/ Radio Pakistan.....**www.radio.gov.pk**
Palau, T8WH/WHRI/Sound of Hope Radio**www.whr.org/**
Philippines, PBS/ Radyo Pilipinas.....**www.pbs.gov.ph/**
Philippines, FEBC.....**www.febc.ph**
Poland, Polskie Radio Warsaw .....**www.polskieradio.pl**
Romania, Radio Romania International ....**www.rri.ro/**
Russia, Voice of Russia .....**www.ruvr.ru/**
Rwanda, Radio Rwanda .....**www.orinfor.gov.rw/radiorwanda.eng.html**
Saudi Arabia, BSKSA/Saudi Radio.....**www.saudiradio.net/**
Serbia, International Radio of Serbia.....**www.glassrbije.org**
Slovakia, IRRS/Euro Gospel Radio.....**www.nexus.org**
Slovakia, IRRS/Radio City .....**www.nexus.org**
Slovakia, IRRS/Radio Joystick .....**www.nexus.org**
Slovakia, Radio Slovakia International.....**www.rsi.sk**
South Africa, AWR.....**www.awr2.org/**
South Africa, Channel Africa.....**www.channelafrica.org**
South Africa, Radio League.....**www.sarl.org.za**
South Africa, RTE Radio One **www.rte.ie/radio1/**
South Africa, TWR .....**www.twr.org/**
South Korea, KBS World Radio .....**http://rki.kbs.co.kr/english/**
Spain, Radio Exterior de Espana .....**www.ree.rne.es/**
Sri Lanka, SLBC .....**www.slbc.lk**
Swaziland, TWR Africa .....**www.twr.org.za**
Sweden, Radio Sweden .....**www.sr.se/rs/english/**
Syria, Radio Damascus.....**www.rtv.gov.sy/**
Taiwan, Radio Taiwan International .....**http://english.rti.org.tw/**
Thailand, Radio Thailand World Service ...**www.hsk9.com/**
Turkey, Voice of Turkey.....**www.trt.net.tr**
Uganda, Dunamis Shortwave .....**www.biblevoice.org/stations/east-africa**
Uganda, Radio Uganda .....**www.ubconline.co.ug**
UK, BBC World Service.....**www.bbc.co.uk/worldservice/**
UK, Bible Voice Broadcasting.....**www.biblevoice.org/**
United Arab Emirates, FEBA Radio .....**www.febaradio.info**
United States, Overcomer Ministries.....**www.overcomerministry.org/**
USA, American Forces Network .....**http://myafn.dodmedia.osd.mil/**
USA, EWTN/WEWN Vandiver AL .....**www.ewtn.com**
USA, KNLS Anchor Point AK.....**www.knls.org/**
USA, Voice of America .....**www.voanews.com/**
USA, Voice of America/Special English.....**www.voanews.com/**
USA, WBCQ Monticello ME.....**www.wbcq.com/**
USA, WHRI Cypress Creek SC .....**www.whr.org/**
USA, WINB Red Lion PA .....**www.winb.com/**
USA, WRMI Miami FL.....**www.wrmi.net/**
USA, WRNO New Orleans LA .....**www.wrnoworldwide.org/**
USA, WTJC Newport NC.....**www.fbnradio.com/**
USA, WTWW Lebanon TN.....**www.wtww.us**
USA, WWCR Nashville TN.....**www.wwcr.com**
USA, WWRB Manchester TN.....**www.wwrb.org/**
USA, WYFR/Family Radio Worldwide .....**www.familyradio.com/**
Uzbekistan, CVC Intl/ The Voice Asia .....**www.christianvision.com/**
Vatican City State, Vatican Radio.....**www.vaticanradio.org**
Vietnam, Voice of Vietnam.....**www.vov.org.vn**
Zambia, 1 Africa Radio/CVC.....**www.1africa.tv**

THE QSL REPORT

VERIFICATIONS RECEIVED BY OUR READERS

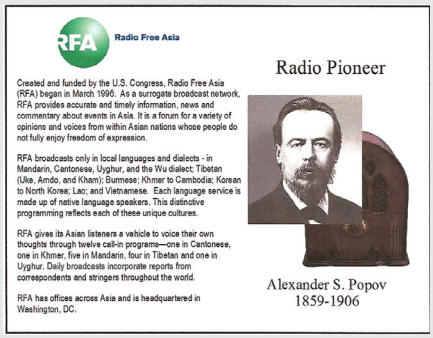
Gayle Van Horn, W4GVH
gaylevanhorn@monitoringtimes.com

Radio Free Asia Releases Fourth Radio Pioneer QSL Card

Radio Free Asia has released its fourth QSL card in its *Radio Pioneer* series. The card honors Russian physicist, Alexander S. Popov, a pioneer in detecting electromagnetic waves and researching oscillator circuitry. Popov is credited as being the first to use an antenna in the transmission and reception of radio waves.

The special QSL will be issued for all valid RFA reception reports to June 30, 2010. Reports may be submitted at **www.techweb.rfa.org** by following the *QSL Reports* link, or to *qsl@rfa.org*. Postal address: Reception Reports, Radio Free Asia, 2025 M. Street NW, Suite 300, Washington, DC 20036 USA.

Radio Free Asia does not broadcast in English; however, their current broadcasting schedule is available via *MT Express*.



Where in the world are Flannan and Formigues Islands?

Those were exactly my thoughts as I read about two amateur radio DXpeditions in June. In a pan-European project, operators will broadcast June 18-21 from Flannan Island, situated in the remote North Atlantic, 20 miles north west of the Outer Hebrides. For broadcasting schedules and QSL info, go to **www.ms0int.com**.

On the heels of Flannan, the same amateur operators will operate as EG3FI from Formigues Gran Island, a behemoth rock covered island off the eastern coast of Spain. Last year's event lasted only a few hours due to excessive sea conditions. Operators will broadcast from June 25 to 26. For additional information and last year's ill fated video, go to **www.tinet.cat/~eg3fi.html**

Clandestine activity increases by two

As shortwave broadcasters reduce broadcast hours or convert to FM and the Internet, clandestine activity continues to expand. Supported by the Hirondelle Foundation, Radio Bar-Kulan (Meeting Place) aims to contribute to peace, stability and prosperity for all Somalia. At press time, activity had been reported on 15750 kHz, 0500-0600 UTC and 9960, 9930 1600-1700 UTC. Contributors, Wendel Craighead and Alokesh Gupta received electronic verifications for details to *barkulanradio@gmail.com*. Website: **www.bar-kulan.com/** or become a fan at Facebook.

La Voix de Djibouti is the first independent radio in the history of Djibouti. The station's goal is "to support the democracy and freedom of speech in one of the most autocratic dictatorship of Eastern Africa.." Broadcasting in Arabic, French and local languages, La Voix de Djibouti airs Thursdays on 15165 kHz, 1530-1630 UTC. Reception reports to: *info@lavoixdejibouti.com*. Website **www.lavoixdedjibouti.com/**

Papua New Guinea to end shortwave

In hobby circles, mention logging stations from Papua New Guinea and you'll hear diverse opinions. For the hard-core hobbyists, PNG monitoring has always been a challenging, but rewarding aspect of tropical band DXing from the Pacific.

NBC Managing Director, Joseph Ealedona, recently stated during a board meeting, "NBC will soon do away with its shortwave and medium wave transmitters, replacing them with the crystal clear FM bands."

No dates have been released, but if PNG intrigues you, do take advantage of their final days. Programming is in Pidgin and brief English, in an easy to follow format. Reception reports are accepted in English and mint postage or currency is preferred

QSLing Tips for Papua New Guinea, is covered in *World QSL Book*, which includes do's, don'ts, and addresses. For additional coverage, consult *MT's* Oct 2003 *Anthology* CD, for my feature, *Exploring Papua New Guinea by Radio*. A complete broadcast schedule is located in *MT Express*. Don't miss an opportunity to log and verify the elusive stations from Papua New Guinea.

It never hurts to say thanks

Thank you to all the readers, and especially to those who have commented on the continued success of my blog *Shortwave Central* **http://mt-shortwave.blogspot.com/** and this column. My mail challenges the notion that shortwave and QSLing are dying. I appreciate all of your suggestions, comments, and contributions. Next month, the July *Firecracker Special* promises to be a jam-packed column of QSLs from across the globe.

DIEGO GARCIA

American Forces Radio 4319 kHz. Full data AFN color logo card unsigned. Received in 115 days for an English report to *QSL@media.osd.mil*. Postal address: American Forces Network Department of Defense, NMC Det AFRTS -DMC,23755 Z Street, Bldg. 2730, Riverside, CA 92518-2017 USA (Frank Hillton, Charleston, SC). Website **http://myafn.dodmedia.osd.mil/**

GREECE

Radiophonikos Stathmos Makedonias 7450 kHz. Full data map folder card and photo post card of Thessaloniki, signed by Tatiana Tsioli. Received in 299 days for an English report and two IRCs (returned). Station address: Aggelaki 14, 546 36 Thessaloniki, Greece. (Bill Wilkins, Springfield, MO). Website **www.ert3.gr/**

MEDIUM WAVE

CJEC 1670 kHz AM. (Radio Enfant). No data station photo medley sheet, unsigned. Received for a French report. Station logo translates as 'the one and only radio of Canada by and for the young people." Station address: 855 Boulevard De La Gappe, Local 310 Gatineau, Québec, Canada (Eric Hopkins, Ayer, MA). Website: **www.enfant.ca**

KURM 790 kHz AM. Report returned as verified by Kent Wourl, stamped with call letters and address. Received in seven days for an AM report, address label and $1.00US. Station address: 113 E. Hope Road, Rogers, AR 72758 USA (Wilkins).

KWMT 540 kHz AM. Handwritten verification statement at bottom of my returned cover letter, for details sent to Duane Marley. Received in 35 days for an AM report. New address for station as: 200 N. 10th Street, Ft. Dodge, IA 50501 USA (Wilkins).

SEYCHELLES

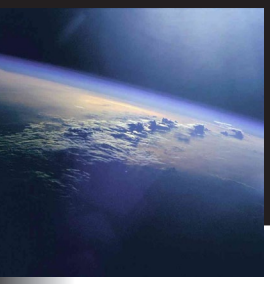
BBC WS relay 9410 kHz. Personal full data verification letter with transmitter site notation, signed by Herve Cherry-Senior Transmitter Engineer. Received in 87 days for an English report, $2.00US, and an applause card. QSL address: VT Group, BBC Indian Ocean Relay Station, P.O. Box 448, Victoria, Seychelles. Email *herve.cherry@vtgroup.sc* (Joe Wood, Greenback, TN).

SLOVAKIA

Radio Slovakia International 6040 kHz. Full data scenery card of church in Lestiny, unsigned. Received in 53 days for an email report to: *englishsection@slovakradio.sk* Postal address: Mytna 1, P.O. Box 55, 817 55 Brtaislava 15, Slovakia (Larry Zamora, Garland, TX)

UKRAINE

Radio Ukraine International 7440 kHz. Full data scenery card of Kiev, unsigned. Received in 66 days for an email report to *vsru@nrcu.gov.ua*. Postal address: Kreshchatik 26, Kyiv, Ukraine 01001 (Zamora).



MTXtra
Shortwave Broadcast Guide

SPANISH

The following language schedule is extracted from our new *MTXtra Shortwave Broadcast Guide* pdf which is a free download to all *MTXpress* subscribers. This new online *Shortwave Broadcast Guide* has more than 9,100 station entries that include all languages being broadcasts via shortwave radio worldwide, sorted by time and updated monthly.

0700 UTC - 3AM EDT / 2AM CDT / 12AM PDT

0700	0800		China, China Radio International		15135eu
0700	0800		Colombia, La Voz de tu Conciencia 5910al		6010do
0700	0800		Colombia, Radio Marfil Estereo 6010al		5910do
0700	0800		Cuba, Radio Havana Cuba	5040va	5970na
			6060sa	6120ca	9660ca 15360sa
0700	0800		Cuba, Radio Rebelde	5025na	
0700	0800		Ecuador, Radio Quito	4919do	
0700	0800		Equatorial Guinea, Radio Bata		5005do
0700	0800		Equatorial Guinea, Radio Malabo		6250do
0700	0800		Honduras, HRMI/ Radio Misiones Intl		3340do
0700	0800		Mexico, XEOI/Radio Mil	6010do	
0700	0800		Mexico, XEPPM/Radio Educacion		6185do
0700	0800		Mexico, XEQM/RASA Onda Corta		6104do
0700	0800		Mexico, XERTA/Radio Transcontinental		4800do
0700	0800		Peru, Radio del Pacifico	4974do	
0700	0800		Peru, Radio Melodia	5940do	
0700	0800		Peru, Radio Santa Monica	4965do	
0700	0800		Peru, Radio Santa Rosa	6047do	
0700	0800		Peru, Radio Union 6114do		
0700	0800		Peru, Radio Victoria	6020do	9720do
0700	0800		Peru, Radio Vision 4790do		
0700	0800		Spain, Radio Exterior de Espana		5965sa
			12035eu	13720eu	17770 pa
0700	0800		Uruguay, Radio Sarandi	6045do	
0700	0800		USA, EWTN/WEWN Vandiver AL 11870ca		7555ca
0700	0800		USA, KVOH Rancho Simi CA	9975ca	
0700	0800		USA, Radio Marti	5980ca	6030ca
0700	0800		USA, WYFR/Family Radio Worldwide		6000ca
			7520eu	9680am	

0800 UTC - 4AM EDT / 3AM CDT / 1AM PDT

0800	0900	fa	Bolivia, Radio Fides	6155do	9624do
0800	0900		Bolivia, Radio Mosoj Chaski	3310do	
0800	0900		Colombia, La Voz de tu Conciencia 5910al		6010do
0800	0900		Colombia, La Voz del Guaviare		6035do
0800	0900		Colombia, Radio Marfil Estereo 6010al		5910do
0800	0900		Cuba, Radio Havana Cuba	5040va	5970na
			6060sa	6120ca	9660ca 15360sa
0800	0900		Cuba, Radio Rebelde	5025na	
0800	0827		Czech Republic, Radio Prague		11600eu
0800	0900		Ecuador, Radio Quito	4919do	
0800	0900		Equatorial Guinea, Radio Bata		5005do
0800	0900		Equatorial Guinea, Radio Malabo		6250do
0800	0900		Greece, Voice of Greece	11645eu	
0800	0900		Honduras, HRMI/ Radio Misiones Intl		3340do
0800	0900		Mexico, XEOI/Radio Mil	6010do	
0800	0900		Mexico, XEPPM/Radio Educacion		6185do
0800	0900		Mexico, XEQM/RASA Onda Corta		6104do
0800	0900		Mexico, XERTA/Radio Transcontinental		4800do
0800	0900		Peru, Radio del Pacifico	4974do	
0800	0900		Peru, Radio Melodia	5940do	
0800	0900		Peru, Radio Santa Monica	4965do	
0800	0900		Peru, Radio Santa Rosa	6047do	
0800	0900		Peru, Radio Union 6114do		
0800	0900		Peru, Radio Victoria	6020do	9720do
0800	0900		Peru, Radio Vision 4790do		
0800	0900	DRM	Spain, Radio Exterior de Espana		9780eu
0800	0900		Spain, Radio Exterior de Espana		12035eu
			13720eu	17770	pa
0800	0900		Uruguay, Radio Sarandi	6045do	
0800	0900		USA, EWTN/WEWN Vandiver AL 11870ca		7555ca
0800	0900		USA, Radio Marti	5980ca	6030ca
0800	0900		USA, WYFR/Family Radio Worldwide		5745ca
			6000ca	9555ca	9715am 11740sa
0830	0900		Bolivia, Radio Pio XII	5952do	

0900 UTC - 5AM EDT / 4AM CDT / 2AM PDT

0900	1000	Bolivia, Radio Causachun Coca		6075do
0900	1000	Bolivia, Radio Fides	6155do	9624do
0900	1000	Bolivia, Radio Logos	4865do	
0900	1000	Bolivia, Radio Loyola	5996do	
0900	1000	Bolivia, Radio Mosoj Chaski	3310do	
0900	1000	Bolivia, Radio Pio XII	5952do	
0900	1000	Bolivia, Radio San Gabriel	6080do	
0900	1000	Bolivia, Radio Santa Cruz	6134do	
0900	1000	Colombia, La Voz de tu Conciencia 5910al		6010do
0900	1000	Colombia, La Voz del Guaviare		6035do
0900	1000	Colombia, Radio Marfil Estereo 6010al		5910do
0900	1000	Cuba, Radio Havana Cuba	5040va	5970na
		6060sa	15360sa	
0900	1000	Cuba, Radio Rebelde	5025na	
0900	1000	Dominican Rep. R Amanecer Internacional 6025va		
0900	1000	Ecuador, La Voz del Napo	3279do	
0900	1000	Ecuador, Radio Quito	4919do	
0900	1000	Equatorial Guinea, Radio Bata		5005do
0900	1000	Equatorial Guinea, Radio Malabo		6250do
0900	1000	Honduras, HRMI/ Radio Misiones Intl		3340do
0900	1000	Mexico, XEOI/Radio Mil	6010do	
0900	1000	Mexico, XEPPM/Radio Educacion		6185do
0900	1000	Mexico, XEQM/RASA Onda Corta		6104do
0900	1000	Mexico, XERTA/Radio Transcontinental		4800do
0900	1000	Peru, Radio del Pacifico	4974do	
0900	1000	Peru, Radio La Voz de la Selva	4824do	
0900	1000	Peru, Radio Libertad de Junin	5039do	
0900	1000	Peru, Radio Maranon	4835do	
0900	1000	Peru, Radio Melodia	5940do	
0900	1000	Peru, Radio Union 6114do		
0900	1000	Peru, Radio Victoria	6020do	9720do
0900	1000	Peru, Radio Vision 4790do		
0900	1000	Spain, Radio Exterior de Espana		21540af
0900	1000	Spain, Radio Exterior de Espana		13720eu
		15585eu	21610as	
0900	1000	Uruguay, Radio Sarandi	6045do	
0900	1000	USA, EWTN/WEWN Vandiver AL 11870ca		7555ca
0900	1000	USA, Radio Marti	5980ca	6030ca
0900	1000	USA, WYFR/Family Radio Worldwide		5745ca
		6000ca	6890am	9495am 9555ca
		9715am	11740sa	
0930	1000	Bolivia, Radio Illimani/Radio Patria Nueva 6025do		
0930	1000	Bolivia, Radio Yura	4716do	
0930	1000	Guatemala, Radio Buenas Nuevas		4799do
0930	1000	Peru, Radio Cusco	6195do	
0930	1000	Peru, Radio Huanta 2000	4747do	4755al
0930	1000	Peru, Radio Tarma	4775do	
0945	1000	Bolivia, Radio Lipez	4796do	
0945	1000	Ecuador, Radio Chaskis del Norte		4909do
0950	1000	Peru, Radio Manantial	4991do	

1000 UTC - 6AM EDT / 5AM CDT / 3AM PDT

1000	1100	Bolivia, Radio Causachun Coca		6075do
1000	1100	Bolivia, Radio Estambul	4498do	
1000	1100	Bolivia, Radio Fides	6155do	9624do
1000	1100	Bolivia, Radio Illimani/Radio Patria Nueva		

6025do
1000 1100 Bolivia, Radio Lipez 4796do
1000 1100 Bolivia, Radio Logos 4865do 6165al
1000 1100 Bolivia, Radio Loyola 5996do
1000 1100 Bolivia, Radio Mosoj Chaski 3310do
1000 1100 Bolivia, Radio Nacional de Huanuni 5967do
1000 1100 Bolivia, Radio Pio XII 5952do
1000 1100 Sun Bolivia, Radio San Gabriel 6080do
1000 1100 Bolivia, Radio San Jose 5580do
1000 1100 Bolivia, Radio San Miguel 4699do
1000 1100 Bolivia, Radio Santa Ana 4451do
1000 1100 Bolivia, Radio Santa Cruz 6134do
1000 1100 Bolivia, Radio Tacana 4781do
1000 1100 Bolivia, Radio Virgen de Remedios 4834do
1000 1100 Bolivia, Radio Yura 4716do
1000 1100 Colombia, La Voz de tu Conciencia 6010do 5910al
1000 1100 Colombia, La Voz del Guaviare 6035do
1000 1100 Colombia, Radio Marfil Estereo 5910do 6010al
1000 1100 Cuba, Radio Havana Cuba 5040va 5970na
1000 1100 Cuba, Radio Nacional de Venezuela 6180ca
1000 1100 Cuba, Radio Nacional de Venezuela 6180am
1000 1100 Cuba, Radio Rebelde 5025na
1000 1100 Dominican Rep. R Amanecer Internacional 6025va
1000 1100 Ecuador, La Voz del Napo 3279do
1000 1100 Ecuador, Radio Chaskis del Norte 4909do
1000 1100 Ecuador, Radio El Buen Pastor 4814do
1000 1100 Ecuador, Radio Quito 4919do
1000 1100 Equatorial Guinea, Radio Bata 5005do
1000 1100 Equatorial Guinea, Radio Malabo 6250do
1000 1100 Guatemala, Radio Buenas Nuevas 4799do
1000 1100 Honduras, HRMI/ Radio Misiones Intl 3340do
1000 1030 Japan, NHK World/ Radio Japan 6120ca 6195sa
1000 1100 Mexico, XEOI/Radio Mil 6010do
1000 1100 Mexico, XEPPM/Radio Educacion 6185do
1000 1100 Mexico, XEQM/RASA Onda Corta 6104do
1000 1100 Mexico, XERTA/Radio Transcontinental 4800do
1000 1100 Peru, Radio Altura 5010do
1000 1100 Peru, Radio Bethel 5949do
1000 1100 Peru, Radio Bolivar 5460do
1000 1100 Peru, Radio Cusco 6195do
1000 1100 Peru, Radio del Pacifico 4974do
1000 1100 Peru, Radio Huanta 2000 4747do 4755al
1000 1100 Peru, Radio La Hora 4857do
1000 1100 Peru, Radio La Reyna de la Selva 5485do
1000 1100 Peru, Radio La Voz De Bolivar 5460do 4755al
1000 1100 Peru, Radio Libertad de Junin 5039do
1000 1030 Sun Peru, Radio Madre de Dios 4950do
1000 1100 Peru, Radio Madre de Dios 4950do
1000 1100 Peru, Radio Manantial 4991do
1000 1100 Peru, Radio Maranon 4835do
1000 1100 Peru, Radio Melodia 5940do
1000 1100 Peru, Radio Ondas del Huallaga 3329do
1000 1100 Peru, Radio Ondas del Suroiente 5120do
1000 1100 Peru, Radio Quillabamba 5025do
1000 1100 Peru, Radio Rasuwilca 4805do
1000 1100 Peru, Radio San Antonio 4940do
1000 1100 Peru, Radio Santa Rosa 6047do
1000 1100 Peru, Radio Sicuani 4826do
1000 1100 Peru, Radio Tarma 4775do
1000 1100 Peru, Radio Tawantinsuyo 6175do
1000 1100 Peru, Radio Union 6114do
1000 1100 Peru, Radio Victoria 6020do 9720do
1000 1100 Peru, Radio Vision 4790do
1000 1100 Spain, Radio Exterior de Espana 21540af
1000 1100 Spain, Radio Exterior de Espana 13720eu 15585eu 21610as
1000 1100 Uruguay, Radio Sarandi 6045do
1000 1100 USA, EWTN/WEWN Vandiver AL 7555ca 12050ca
1000 1100 USA, Radio Marti 5980ca 6030ca
1000 1100 USA, WYFR/Family Radio Worldwide 6000ca 6085ca 9555ca
1000 1100 Venezuela, Radio Amazonas 4940do
1030 1100 Bolivia, Radio Cultural Juan XXIII 6055do
1030 1100 Czech Republic, Radio Prague 9955ca
1045 1100 Peru, Radio La Voz de las Huarinjas 5059do
1059 1100 Netherlands, R Netherlands Worldwide 6165na

1100 UTC - 7AM EDT / 6AM CDT / 4AM PDT

1100 1200 Bolivia, Radio Causachun Coca 6075do
1100 1200 Bolivia, Radio Cultural Juan XXIII 6055do
1100 1200 Bolivia, Radio Estambul 4498do
1100 1200 Bolivia, Radio Fides 6155do 9624do
1100 1200 Bolivia, Radio Illimani/Radio Patria Nueva 6025do
1100 1200 Bolivia, Radio Logos 4865do 6165al
1100 1140 Bolivia, Radio Mosoj Chaski 3310do
1100 1200 Sun Bolivia, Radio Mosoj Chaski 3310do
1100 1200 Bolivia, Radio Nacional de Huanuni 5967do
1100 1200 Bolivia, Radio Pio XII 5952do
1100 1200 Bolivia, Radio San Gabriel 6080do
1100 1200 Bolivia, Radio San Jose 5580do
1100 1200 Bolivia, Radio San Miguel 4699do
1100 1200 Bolivia, Radio Santa Ana 4451do
1100 1200 Bolivia, Radio Santa Cruz 6134do
1100 1200 Bolivia, Radio Tacana 4781do
1100 1200 Bolivia, Radio Yura 4716do
1100 1200 Colombia, La Voz de tu Conciencia 6010do 5910al
1100 1200 Colombia, La Voz del Guaviare 6035do
1100 1200 Colombia, Radio Marfil Estereo 5910do 6010al
1100 1200 Cuba, Radio Havana Cuba 6060sa 6110am 6150am 6180na 9600na 11730ca 11760am 12030ca 13680na 15120sa 15360sa 15380sa
1100 1200 Cuba, Radio Nacional de Venezuela 6060ca
1100 1200 Cuba, Radio Nacional de Venezuela 6060am
1100 1200 Cuba, Radio Rebelde 5025na
1100 1200 Dominican Rep. R Amanecer Internacional 6025va
1100 1200 Ecuador, HCJB Global 6050sa
1100 1130 Ecuador, La Voz del Napo 3279do
1100 1145 Ecuador, Radio Chaskis del Norte 4909do
1100 1200 Ecuador, Radio El Buen Pastor 4814do
1100 1200 Ecuador, Radio Quito 4919do
1100 1200 Equatorial Guinea, Radio Bata 5005do
1100 1200 Equatorial Guinea, Radio Malabo 6250do
1100 1200 Guatemala, Radio Buenas Nuevas 4799do
1100 1200 Honduras, HRMI/ Radio Misiones Intl 3340do
1100 1200 Honduras, Radio Luz y Vida 3250do
1100 1200 Mexico, XEOI/Radio Mil 6010do
1100 1200 Mexico, XEPPM/Radio Educacion 6185do
1100 1200 Mexico, XEQM/RASA Onda Corta 6104do
1100 1200 Mexico, XERTA/Radio Transcontinental 4800do
1100 1127 Netherlands, R Netherlands Worldwide 6165na
1100 1200 Sun Peru, Radio Altura 5010do
1100 1200 Peru, Radio Bethel 5949do
1100 1200 Peru, Radio Bolivar 5460do
1100 1200 Peru, Radio Cultural Amauta 4955do
1100 1200 Peru, Radio Cusco 6195do
1100 1200 Peru, Radio del Pacifico 4974do
1100 1200 Peru, Radio Huanta 2000 4747do 4755al
1100 1200 Peru, Radio La Hora 4857do
1100 1200 Peru, Radio La Reyna de la Selva 5485do
1100 1200 Peru, Radio La Voz De Bolivar 5460do
1100 1200 Sun Peru, Radio La Voz de la Selva 4824do
1100 1200 Peru, Radio La Voz de las Huarinjas 5059do
1100 1200 Peru, Radio Libertad de Junin 5039do
1100 1200 Peru, Radio Madre de Dios 4950do
1100 1200 Peru, Radio Manantial 4991do
1100 1200 Peru, Radio Melodia 5940do
1100 1200 Peru, Radio Ondas del Huallaga 3329do
1100 1200 Peru, Radio Ondas del Suroiente 5120do
1100 1200 Peru, Radio Quillabamba 5025do
1100 1130 Peru, Radio Rasuwilca 4805do
1100 1200 Peru, Radio San Antonio 4940do
1100 1200 Peru, Radio San Nicolas 5470do
1100 1200 Peru, Radio Santa Rosa 6047do
1100 1200 Peru, Radio Sicuani 4826do
1100 1200 Peru, Radio Tarma 4775do
1100 1200 Peru, Radio Tawantinsuyo 6175do
1100 1200 Peru, Radio Union 6114do
1100 1200 Peru, Radio Victoria 6020do 9720do
1100 1200 Peru, Radio Vision 4790do
1100 1200 South Korea, KBS World Radio 11795eu
1100 1200 mtwhf Spain, Radio Exterior de Espana 21540af
1100 1200 Spain, Radio Exterior de Espana 13720eu 15585eu 21610as
1100 1200 Uruguay, Radio Sarandi 6045do
1100 1200 USA, EWTN/WEWN Vandiver AL 7555ca 12050ca
1100 1200 USA, Radio Marti 5745ca 5980ca 6030ca
1100 1200 USA, WYFR/Family Radio Worldwide 6085ca 6855am 9555ca 9575ca 9605am

			9705am	11740sa		
1100	1200		Venezuela, Radio Amazonas	4940do		
1129	1157		Netherlands, R Netherlands Worldwide			6165sa
1130	1200	mtwhf	USA, Voice of America	9885ca		13715ca
			15590ca			
1130	1200		Vatican City State, Vatican Radio			21660am
1159	1200		Netherlands, R Netherlands Worldwide			9715ca
			9895sa			

1200 UTC - 8AM EDT / 7AM CDT / 5AM PDT

1200	1300	mtwhf	Argentina, Radio Nacional RAE			11710am
1200	1300		Bolivia, Radio Causachun Coca			6075do
1200	1300		Bolivia, Radio Cultural Juan XXIII			6055do
1200	1300		Bolivia, Radio Estambul	4498do		
1200	1300		Bolivia, Radio Fides	6155do		9624do
1200	1300		Bolivia, Radio Illimani/Radio Patria Nueva			
			6025do			
1200	1300		Bolivia, Radio Logos	4865do		6165al
1200	1300		Bolivia, Radio Nacional de Huanuni			5967do
1200	1300		Bolivia, Radio Pio XII	5952do		
1200	1300		Bolivia, Radio San Gabriel	6080do		
1200	1300		Bolivia, Radio San Jose	5580do		
1200	1300		Bolivia, Radio San Miguel	4699do		
1200	1300		Bolivia, Radio Santa Ana	4451do		
1200	1300		Bolivia, Radio Santa Cruz	6134do		
1200	1300		Bolivia, Radio Tacana	4781do		
1200	1300		Chile, La Voz Crista	9635sa		17680sa
1200	1300		Colombia, La Voz de tu Conciencia			6010do
			5910al			
1200	1300		Colombia, La Voz del Guaviare			6035do
1200	1300		Colombia, Radio Marfil Estereo			5910do
			6010al			
1200	1300		Cuba, Radio Havana Cuba	6060sa		6110am
			6150am	6180na	9600na	11730ca
			11760am	12030ca	13680na	15120sa
			15360sa	15380sa		
1200	1300		Cuba, Radio Nacional de Venezuela			11705ca
1200	1300		Cuba, Radio Nacional de Venezuela			11705am
1200	1300		Cuba, Radio Rebelde	5025na		
1200	1300		Dominican Rep. R Amanecer Internacional			
			6025va			
1200	1300		Ecuador, HCJB Global	6050sa		
1200	1300		Ecuador, Radio El Buen Pastor	4814do		
1200	1300		Ecuador, Radio Quito	4919do		
1200	1300		Equatorial Guinea, Radio Bata			5005do
1200	1300		Equatorial Guinea, Radio Malabo			6250do
1200	1300		Guatemala, Radio Buenas Nuevas			4799do
1200	1300		Honduras, HRMI/ Radio Misiones Intl			3340do
1200	1300		Honduras, Radio Luz y Vida	3250do		
1200	1300		Mexico, XEOI/Radio Mil	6010do		
1200	1300		Mexico, XEQM/RASA Onda Corta			6104do
1200	1300		Mexico, XERTA/Radio Transcontinental			4800do
1200	1300		Mexico, XEXQ/Radio Universidad			6045do
1200	1300		Mexico, XEXQ/Radio Universidad			6045do
1200	1227		Netherlands, R Netherlands Worldwide			9715ca
			9895sa			
1200	1300		Peru, Radio Altura 5010do			
1200	1300		Peru, Radio Bethel 5949do			
1200	1300		Peru, Radio Bolivar	5460do		
1200	1300		Peru, Radio Cultural Amauta	4955do		
1200	1300		Peru, Radio Cusco 6195do			
1200	1300		Peru, Radio del Pacifico	4974do		
1200	1300		Peru, Radio Huanta 2000	4747do		4755al
1200	1300		Peru, Radio La Hora	4857do		
1200	1300		Peru, Radio La Reyna de la Selva			5485do
1200	1300	Sun	Peru, Radio La Voz de la Selva	4824do		
1200	1300		Peru, Radio La Voz de las Huarinjas			5059do
1200	1300		Peru, Radio Libertad de Junin	5039do		
1200	1300		Peru, Radio Madre de Dios	4950do		
1200	1300		Peru, Radio Manantial	4991do		
1200	1300		Peru, Radio Maranon	4835do		
1200	1300		Peru, Radio Melodia	5940do		
1200	1300		Peru, Radio Ondas del Huallaga			3329do
1200	1300		Peru, Radio Ondas del Suroiente			5120do
1200	1300		Peru, Radio Quillabamba	5025do		
1200	1230		Peru, Radio San Nicolas	5470do		
1200	1300		Peru, Radio Santa Rosa	6047do		
1200	1300		Peru, Radio Sicuani	4826do		
1200	1300		Peru, Radio Tarma 4775do			
1200	1300		Peru, Radio Tawantinsuyo	6175do		
1200	1300		Peru, Radio Union 6114do			
1200	1300		Peru, Radio Victoria	6020do		9720do
1200	1300		Peru, Radio Vision 4790do			
1200	1300		Spain, Radio Exterior de Espana			11910as
			15585eu	21540af	21610as	
1200	1300	mtwhf	Spain, Radio Exterior de Espana			5930sa
			5970ca	15170na		
1200	1300	Sun	Spain, Radio Exterior de Espana			9765ca
			11815sa	15170na		
1200	1300	Sat/Sun	Spain, Radio Exterior de Espana			13720eu
1200	1215	mtwhf	UK, BBC World Service	9410ca		11860ca
1200	1300		Uruguay, Radio Sarandi	6045do		
1200	1300		USA, EWTN/WEWN Vandiver AL			7555ca
			12050ca			
1200	1300		USA, Radio Marti 5745ca		5980ca	7405ca
1200	1300		USA, Voice of America	9885ca		13715ca
			15590ca			
1200	1300	Sat/Sun	USA, WHRI Cypress Creek SC			9410ca
1200	1300		USA, WYFR/Family Radio Worldwide			6085ca
			9555ca	9705am	11725am	11740sa
			13615sa			
1200	1300		Venezuela, Radio Amazonas	4940do		
1205	1300		Canada, Radio Canada International			7325na

1300 UTC - 9AM EDT / 8AM CDT / 6AM PDT

1300	1400	mtwhf	Argentina, Radio Nacional RAE			11710am
1300	1400		Bolivia, Radio Causachun Coca			6075do
1300	1400		Bolivia, Radio Cultural Juan XXIII			6055do
1300	1400		Bolivia, Radio Estambul	4498do		
1300	1400		Bolivia, Radio Fides	6155do		9624do
1300	1400		Bolivia, Radio Illimani/Radio Patria Nueva			
			6025do			
1300	1400		Bolivia, Radio Logos	4865do		6165al
1300	1400		Bolivia, Radio Nacional de Huanuni			5967do
1300	1400		Bolivia, Radio Pio XII	5952do		
1300	1400		Bolivia, Radio San Gabriel	6080do		
1300	1400		Bolivia, Radio San Jose	5580do		
1300	1400		Bolivia, Radio San Miguel	4699do		
1300	1400		Bolivia, Radio Santa Ana	4451do		
1300	1400		Bolivia, Radio Santa Cruz	6134do		
1300	1400		Bolivia, Radio Tacana	4781do		
1300	1305		Canada, Radio Canada International			7325na
1300	1400		Chile, La Voz Crista	9635sa		17680sa
1300	1400		Colombia, La Voz de tu Conciencia			6010do
			5910al			
1300	1400		Colombia, La Voz del Guaviare			6035do
1300	1400		Colombia, Radio Marfil Estereo			5910do
			6010al			
1300	1400		Cuba, Radio Havana Cuba	6060sa		6110am
			6150am	9600na	11730ca	11760am
			12030ca	13680na	13780na	15120sa
			15360sa	15380sa		
1300	1400		Cuba, Radio Rebelde	5025na		
1300	1400		Dominican Rep. R Amanecer Internacional			
			6025va			
1300	1400		Ecuador, HCJB Global	6050sa		
1300	1400	Sun	Ecuador, La Voz del Napo	3279do		
1300	1400		Ecuador, Radio El Buen Pastor	4814do		
1300	1400		Ecuador, Radio Quito	4919do		
1300	1400		Equatorial Guinea, Radio Bata			5005do
1300	1400		Equatorial Guinea, Radio Malabo			6250do
1300	1400		Guatemala, Radio Buenas Nuevas			4799do
1300	1400		Honduras, HRMI/ Radio Misiones Intl			3340do
1300	1400		Honduras, Radio Luz y Vida	3250do		
1300	1400		Mexico, XEOI/Radio Mil	6010do		
1300	1400		Mexico, XEQM/RASA Onda Corta			6104do
1300	1400		Mexico, XERTA/Radio Transcontinental			4800do
1300	1400		Mexico, XEXQ/Radio Universidad			6045do
1300	1400		Peru, Radio Altura 5010do			
1300	1400		Peru, Radio Bethel 5949do			
1300	1400		Peru, Radio Cultural Amauta	4955do		
1300	1400		Peru, Radio Cusco 6195do			
1300	1400		Peru, Radio del Pacifico	4974do		
1300	1400		Peru, Radio La Hora	4857do		
1300	1400		Peru, Radio La Reyna de la Selva			5485do
1300	1400	Sun	Peru, Radio La Voz de la Selva	4824do		
1300	1400		Peru, Radio Libertad de Junin	5039do		
1300	1400		Peru, Radio Madre de Dios	4950do		
1300	1400		Peru, Radio Manantial	4991do		
1300	1400		Peru, Radio Melodia	5940do		
1300	1400		Peru, Radio Ondas del Huallaga			3329do
1300	1400		Peru, Radio Ondas del Suroiente			5120do
1300	1400		Peru, Radio Quillabamba	5025do		
1300	1400		Peru, Radio Santa Rosa	6047do		
1300	1400		Peru, Radio Sicuani	4826do		
1300	1400		Peru, Radio Tarma 4775do			
1300	1400		Peru, Radio Tawantinsuyo	6175do		
1300	1400		Peru, Radio Union 6114do			
1300	1400		Peru, Radio Victoria	6020do		9720do

1300	1400		Peru, Radio Vision 4790do				
1300	1400		Spain, Radio Exterior de Espana 15585eu	17595na	21540af	11910as 21570sa 21610as	
1300	1400	mtwhf	Spain, Radio Exterior de Espana 5970ca	15170na		5930sa	
1300	1400	Sat/Sun	Spain, Radio Exterior de Espana			17595sa	
1300	1400	Sun	Spain, Radio Exterior de Espana 11815sa	15170na		9765ca	
1300	1400		Uruguay, Radio Sarandi	6045do			
1300	1400		USA, EWTN/WEWN Vandiver AL 12070ca			11550ca	
1300	1400		USA, KVOH Rancho Simi CA	9975ca			
1300	1400		USA, Radio Marti 5745ca	7405ca		11930ca	
1300	1400		USA, WYFR/Family Radio Worldwide 9555ca	11725am	13615am	6085ca 15135am 15355am	
1300	1400		Venezuela, Radio Amazonas	4940do			

1400 UTC - 10AM EDT / 9AM CDT / 7AM PDT

1400	1500		Bolivia, Radio Causachun Coca			6075do	
1400	1500		Bolivia, Radio Cultural Juan XXIII			6055do	
1400	1500		Bolivia, Radio Estambul	4498do			
1400	1500		Bolivia, Radio Fides	6155do	9624do		
1400	1500		Bolivia, Radio Illimani/Radio Patria Nueva 6025do				
1400	1500		Bolivia, Radio Logos	4865do	6165al		
1400	1500		Bolivia, Radio Nacional de Huanuni			5967do	
1400	1500		Bolivia, Radio San Gabriel	6080do			
1400	1500		Bolivia, Radio San Jose	5580do			
1400	1500		Bolivia, Radio San Miguel	4699do			
1400	1500		Bolivia, Radio Santa Ana	4451do			
1400	1500		Bolivia, Radio Santa Cruz	6134do			
1400	1500		Bolivia, Radio Tacana	4781do			
1400	1500		Chile, La Voz Crista	9635sa	17680sa		
1400	1500		Colombia, La Voz de tu Conciencia 5910al			6010do	
1400	1500		Colombia, La Voz del Guaviare			6035do	
1400	1500		Colombia, Radio Marfil Estereo 6010al			5910do	
1400	1500		Cuba, Radio Havana Cuba 6150am	9600na	11730ca	6060sa 11760am	6110am 12030ca 13680na 13780na 15120sa 15360sa 15380sa
1400	1500	Sun	Cuba, Radio Havana Cuba 13680ca	13750na	17750sa	11690ca	12010sa
1400	1500	Sun	Cuba, Radio Nacional de Venezuela 12010am	13680am	13750am	11690am	17750am
1400	1500		Cuba, Radio Rebelde	5025na			
1400	1427		Czech Republic, Radio Prague			11720	ei
1400	1500		Dominican Rep. R Amanecer Internacional 6025va				
1400	1500		Ecuador, HCJB Global	6050sa			
1400	1500		Ecuador, Radio El Buen Pastor	4814do			
1400	1500		Ecuador, Radio Quito	4919do			
1400	1500		Equatorial Guinea, Radio Bata			5005do	
1400	1500		Equatorial Guinea, Radio Malabo			6250do	
1400	1500		Guatemala, Radio Buenas Nuevas			4799do	
1400	1500		Honduras, HRMI/ Radio Misiones Intl			3340do	
1400	1500		Honduras, Radio Luz y Vida	3250do			
1400	1500		Mexico, XEOI/Radio Mil	6010do			
1400	1500		Mexico, XEQM/RASA Onda Corta			6104do	
1400	1500		Mexico, XERTA/Radio Transcontinental			4800do	
1400	1500		Mexico, XEXQ/Radio Universidad			6045do	
1400	1500		Peru, Radio Altura 5010do				
1400	1500		Peru, Radio Bethel 5949do				
1400	1500		Peru, Radio Cusco 6195do				
1400	1500		Peru, Radio del Pacifico	4974do			
1400	1500		Peru, Radio La Hora	4857do			
1400	1500		Peru, Radio La Reyna de la Selva			5485do	
1400	1500	Sun	Peru, Radio La Voz de la Selva	4824do			
1400	1500		Peru, Radio La Voz de las Huarinjas			5059do	
1400	1500		Peru, Radio Libertad de Junin	5039do			
1400	1500		Peru, Radio Madre de Dios	4950do			
1400	1500		Peru, Radio Manantial	4991do			
1400	1500		Peru, Radio Maranon	4835do			
1400	1500		Peru, Radio Melodia	5940do			
1400	1500		Peru, Radio Ondas del Huallaga			3329do	
1400	1500		Peru, Radio Ondas del Suroiente			5120do	
1400	1500		Peru, Radio Quillabamba	5025do			
1400	1500		Peru, Radio Santa Rosa	6047do			
1400	1500		Peru, Radio Sicuani	4826do			
1400	1500		Peru, Radio Tarma 4775do				
1400	1500		Peru, Radio Tawantinsuyo	6175do			
1400	1500		Peru, Radio Union 6114do				
1400	1500		Peru, Radio Victoria	6020do	9720do		
1400	1500		Peru, Radio Vision 4790do				
1400	1500	mtwhf	Spain, Radio Exterior de Espana 5970ca	15170na	17595na	5930sa	21540af
1400	1500	Sat	Spain, Radio Exterior de Espana			11815sa	
1400	1500	Sat/Sun	Spain, Radio Exterior de Espana 17755af			17595sa	
1400	1500	Sun	Spain, Radio Exterior de Espana 15170na			9765ca	
1400	1500		Spain, Radio Exterior de Espana 21570sa	21610as		15585eu	
1400	1500		Uruguay, Radio Sarandi	6045do			
1400	1500		USA, EWTN/WEWN Vandiver AL 12070ca			11550ca	
1400	1500		USA, KVOH Rancho Simi CA	9975ca			
1400	1500		USA, Radio Marti 11930ca	13820ca		15330ca	
1400	1500		USA, WYFR/Family Radio Worldwide 11725am	11740sa	11830am	6085ca	13615am 15135am 15355sa 17555sa
1400	1415		Vatican City State, Vatican Radio 9645eu			7250eu	
1400	1500		Venezuela, Radio Amazonas	4940do			
1430	1500		Slovakia, Radio Slovakia International 11670eu			9440eu	

1500 UTC - 11AM EDT / 10AM CDT / 8AM PDT

1500	1600		Bolivia, Radio Causachun Coca			6075do	
1500	1600		Bolivia, Radio Cultural Juan XXIII			6055do	
1500	1600		Bolivia, Radio Eco 4409do				
1500	1600		Bolivia, Radio Estambul	4498do			
1500	1600		Bolivia, Radio Fides	6155do	9624do		
1500	1600		Bolivia, Radio Illimani/Radio Patria Nueva 6025do				
1500	1600		Bolivia, Radio Logos	4865do	6165al		
1500	1600		Bolivia, Radio Nacional de Huanuni			5967do	
1500	1600		Bolivia, Radio San Gabriel	6080do			
1500	1600		Bolivia, Radio San Jose	5580do			
1500	1600		Bolivia, Radio San Miguel	4699do			
1500	1600		Bolivia, Radio Santa Ana	4451do			
1500	1600		Bolivia, Radio Santa Cruz	6134do			
1500	1600		Bolivia, Radio Tacana	4781do			
1500	1600		Chile, La Voz Crista	9635sa	17680sa		
1500	1600		Colombia, La Voz de tu Conciencia 5910al			6010do	
1500	1600		Colombia, La Voz del Guaviare			6035do	
1500	1600		Colombia, Radio Marfil Estereo 6010al			5910do	
1500	1600		Cuba, Radio Havana Cuba 11730ca	6110am 11760am	15120sa	6150am	15380sa
1500	1600	Sun	Cuba, Radio Nacional de Venezuela 12010am	13680am	13750am	11690am	17750am
1500	1600		Cuba, Radio Nacional de Venezuela			11680am	
1500	1600		Cuba, Radio Rebelde	5025na			
1500	1600		Dominican Rep. R Amanecer Internacional 6025va				
1500	1600		Ecuador, Radio El Buen Pastor	4814do			
1500	1600		Ecuador, Radio Quito	4919do			
1500	1600		Equatorial Guinea, Radio Bata			5005do	
1500	1600		Equatorial Guinea, Radio Malabo			6250do	
1500	1545		Guatemala, Radio Buenas Nuevas			4799do	
1500	1600		Honduras, HRMI/ Radio Misiones Intl			3340do	
1500	1600		Honduras, Radio Luz y Vida	3250do			
1500	1600		Mexico, XEOI/Radio Mil	6010do			
1500	1600		Mexico, XEQM/RASA Onda Corta			6104do	
1500	1600		Mexico, XERTA/Radio Transcontinental			4800do	
1500	1600		Mexico, XEXQ/Radio Universidad			6045do	
1500	1600		Peru, Radio Altura 5010do				
1500	1600		Peru, Radio Bethel 5949do				
1500	1600		Peru, Radio Cusco 6195do				
1500	1600		Peru, Radio del Pacifico	4974do			
1500	1600		Peru, Radio La Hora	4857do			

WANT MORE?

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Jeffrey Lichtman
jeff@radioastronomysupplies.com

Antennas for Radio Astronomy

Antennas are the ears of any receiving system. Without the antenna, the receiver chain would not receive a signal or usable data. Antennas range in size and shape from the smallest patch type up to the size of the Green Bank Telescope (GBT). All have a specific frequency range and characteristic which make them unique.

Understanding the basic antenna principles is very important, especially to those designing and building a usable antenna.

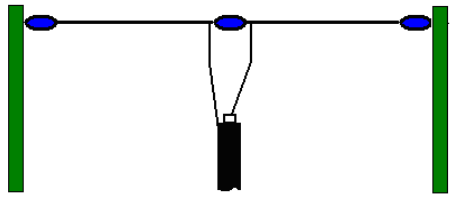
❖ Dipole Antenna

The dipole antenna is a straight electrical conductor measuring 1/2 wavelength from end to end and connected at the center to a radio-frequency (RF) feed line. This antenna, also called a doublet, is one of the simplest types of antenna, and it constitutes the main RF radiating and receiving element in various sophisticated types of antennas. The dipole is inherently a balanced antenna, because it is bilaterally symmetrical.

Ideally, a dipole antenna is fed with a balanced, parallel-wire RF transmission line. However, this type of line is not common. An unbalanced feed line, such as coaxial cable, can be used, but to ensure optimum RF current distribution on the antenna element and in the feed line, an RF transformer called a balun (contraction of the words "balanced" and "unbalanced") should be inserted in the system at the point where the feed line joins the antenna.

For best performance, a dipole antenna should be more than 1/2 wavelength above the ground, the surface of a body of water, or other horizontal, conducting medium such as sheet metal roofing. The element should also be at least several wavelengths away from electrically conducting obstructions such as supporting towers, utility wires, guy wires, and other antennas.

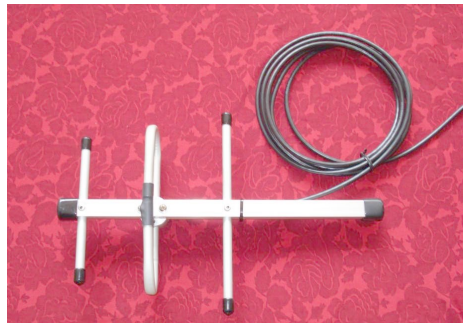
Dipole antennas can be oriented horizontally, vertically, or at a slant. The polarization of the electromagnetic field (EM) radiated by a dipole transmitting antenna corresponds to the orientation of the element. When the antenna is used to receive RF signals, it is most sensitive to EM fields whose polarization is parallel to the orientation of the element. The RF current in a dipole is maximum at the center (the point where the feed line joins the element), and is minimum at the ends of the element. The RF voltage is maximum at the ends and is minimum at the center.



(http://whatis.techtarget.com/)

❖ Yagi Antenna

A Yagi antenna, also known as a Yagi-Uda array or simply a Yagi, is a unidirectional antenna commonly used in communications when a frequency is above 10 MHz. This type of antenna is popular among Amateur Radio and Citizens Band radio operators. It is used at some surface installations in satellite communications systems.



A basic Yagi consists of two or three straight elements, each measuring approximately 1/2 electrical wavelengths. The antenna can be balanced or unbalanced. The Yagi is inherently a balanced antenna, but it can be fed with coaxial cable and a device called a balun at the point where the feed line joins the driven element.

The driven element of a Yagi is the equivalent of a center-fed, half-wave dipole antenna. Parallel to the driven element, and approximately 0.2 to 0.5 wavelength on either side of it, are straight rods or wires called reflectors and directors. A reflector is placed behind the driven element and is slightly longer than 1/2 wavelength; a director is placed in front of the driven element and is slightly shorter than 1/2 wavelength.

A typical Yagi has one reflector and one or more directors. The antenna propagates electromagnetic field energy in the direction running from the driven element toward the director(s), and is most sensitive to incoming electromagnetic field energy in this same direction.

The Yagi antenna not only has a unidirectional radiation and response pattern, but it concentrates the radiation and response. The more directors a Yagi has, the greater the so-called forward gain. As more directors are added to a Yagi, it becomes longer. Some Yagi antennas have as many as 10 or even 12 directors in addition to the driven element and one reflector. Long Yagis are rarely used below 50 MHz, because at these frequencies the structure becomes physically unwieldy. (**http://whatis.techtarget.com/**)

❖ Corner Reflector Antenna

The Corner Reflector antenna in some cases, is similar to a dish antenna, but only in the way it reflects the incoming signal.

It consists of two flat screens or metal plates, situated at 90 degrees from each other, with a half-wave dipole at the focal point. In some cases, the reflector plates may also be at 45 degrees or 60 degrees for various gain requirements.

REFLECTOR PLATE ANGLE	S - DISTANCE	APPROXIMATE GAIN (dB)
45	0.4	Approx. 13.8 dB
60	0.3	Approx. 11.5 dB
90	0.2	Approx. 9 dB

The impedance can vary between 40 to 75 Ohms, depending on the distance from the dipole to the vertex. Refer to the following table:

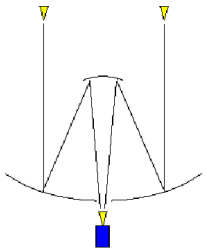
The materials used to fabricate the reflector portion may be mesh screening or solid, thin gauge aluminum plate. The frame, if required for the design, may be PVC tubing or any other rigid material.

❖ Parabolic Dish Antenna

A dish antenna, also known simply as a dish, is common in microwave systems. This type of antenna can be used for satellite communication and broadcast reception, space communications, radio astronomy, and radar.

A dish antenna consists of an active, or driven, element and a passive parabolic or spherical reflector. The driven element can be a dipole antenna or a horn antenna. If a horn is used, it is aimed back at the center of the reflecting dish. The reflector has a diameter of at least several wavelengths. As the wavelength increases (and the frequency decreases), the minimum required dish diameter becomes larger.

When the dipole or horn is properly positioned and aimed, incoming electromagnetic fields bounce off the reflector, and the energy converges on the driven element. If the horn or dipole is connected to a transmitter, the element emits electromagnetic waves that bounce off the reflector and propagate outward in a narrow beam. **(http://whatis.techtarget.com/)**

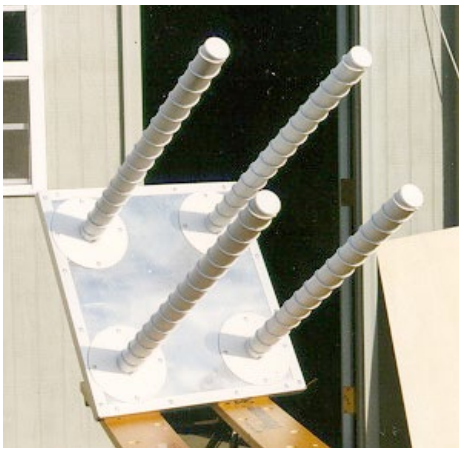


Standard Type Parabolic Antenna, Illustrating Incoming Signal to Feedhorn

A dish antenna is usually operated with an unbalanced feed line. For satellite television reception, coaxial cable is used. In applications such as radar where a high-power signal is transmitted, a feed system is preferred. Note: For Radio Astronomy applications, low loss coaxial cable is used as well as, hardline and waveguide assemblies.

❖ Helical Antenna

A helical antenna is a specialized antenna that emits and responds to electromagnetic fields with rotating (circular) polarization. These antennas are commonly used at earth-based stations in satellite communications systems. This type of antenna is designed for use with an unbalanced feed line such as coaxial cable. The center conductor of the cable is connected to the helical element, and the shield of the cable is connected to the reflector.



To the casual observer, a helical antenna appears as one or more "springs" or helixes mounted against a flat reflecting screen. The length of the helical element is one wavelength or greater. The reflector is a circular or square metal mesh or sheet whose cross dimension (diameter or edge) measures at least 3/4 wavelength. The helical element has a radius of 1/8 to 1/4 wavelength, and a pitch of 1/4 to 1/2 wavelength. The minimum dimensions depend on the lowest frequency at which the antenna is to be used. If the helix or reflector is too small (the frequency is too low), the efficiency is severely degraded. Maximum radiation and response occur along the axis of the helix.

Helical antennas are commonly connected together in so-called bays of two, four, or occasionally more elements with a common reflector. The entire assembly can be rotated in the horizontal (azimuth) and vertical (elevation) planes, so the system can be aimed toward a particular satellite. If the satellite is not in a geostationary orbit, the azimuth and elevation rotators can be operated by a computerized robot that is programmed to follow the course of the satellite across the sky.

John Kraus, W8JK, has contributed vastly to many advancements in antenna design by exploiting the electromagnetic spectrum. These improvements are still enjoyed today by all amateur radio operators. He invented several new antennas over the years, including the W8JK-beam antenna, the helical antenna, and, most recognizable, the "Big Ear" antenna.

Note: John became a Professor at Ohio State. During his tenure, he authored many articles and textbooks. He wrote an interesting story of the early years entitled "Big Ear." Professor Kraus has often given presentations at local amateur radio clubs in the Columbus, Ohio area

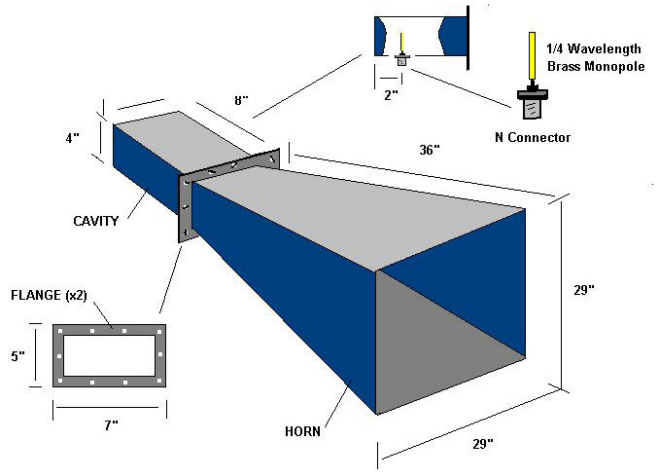
❖ Horn Antenna

A horn antenna is used for the transmission and reception of microwave signals. It derives its name from the characteristic flared appearance. The flared portion can be square, rectangular, or conical. The maximum radiation and response corresponds with the axis of the horn. In this respect, the antenna resembles an acoustic horn. It is usually fed with a waveguide.

In order to function properly, a horn antenna must be a certain minimum size relative to the wavelength of the incoming or outgoing electromagnetic field. If the horn is too small or the wavelength is too large (the frequency is too low), the antenna will not work efficiently.

Horn antennas are commonly used as the active element in a dish antenna. The horn is pointed toward the center of the dish reflector. The use of a horn, rather than a dipole antenna or any other type of antenna, at the focal point of the dish minimizes loss of energy (leakage) around the edges of the dish reflector. It also minimizes the response of the antenna to unwanted signals not in the favored direction of the dish.

Horn antennas are used all by themselves in short-range radar systems, particularly those used by law-enforcement personnel to measure the speeds of approaching or retreating vehicles.



Acknowledgements

Supplemental information was supplied by Robert Grove (Grove Enterprises), the *ARRL Antenna Handbook),* and **http://whatis.techtarget.com/**

Further Reading

Antennas by John D. Daniel Kraus, Ronald J. Marhefka
Antenna Anthology by Bob Grove (*All About Antennas* is currently being serialized in *MT*)
Antenna Engineering Handbook by Richard C. Johnson, Henry Jasik (Editor)
Antenna Theory: Analysis and Design by Constantine A. Balanis, Steven Elliot (Editor), Jaime Perea (Illustrator), Designed by Harry Nolan
Antenna Theory and Design by Warren L. Stutzman, Gary A. Theile, Gary A. Thiele
Phased Array Antenna Handbook by Robert J. Mailloux
Practical Antenna Handbook by Joseph J. Carr
The ARRL Antenna Book with Cdrom by R. Dean Straw (Editor), Kurt Andress, L. B. Cebik, Rudy Severns, Frank Witt
The ARRL UHF/Microwave Experimenter's Manual: Antennas, Components and Design - Foreword by David Sumner

MILCOM
MONITORING MILITARY COMMUNICATIONS

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Are the Ute Bands Really Dead?

A nearly constant drum beat has been heard for the last few years on various HF radio newsgroups and in mail to this column to say, "HF is dead and there is nothing left to hear on the utility bands."

Every time I hear that familiar refrain I can't help but chuckle, and also feel a bit sad for those who believe those words, because nothing could be further from the truth.

So, for my "the skies are falling" monitoring friends who continue to deny what they can't hear because the technology has left them behind, I have written this column. Maybe this message will help bring them into the 21st century of monitoring HF government/military communications.

But, before I proceed, let me say that if you aren't willing to purchase a computer and would still rather use a typewriter to send snail mail, this column is not for you. Maybe it is time the flip the page to another column in this edition of *MT*. On the other hand, if you are truly interested in monitoring government and military HF communications and are willing to do what is necessary to find them, please read on.

❖ HF Comms on the Rebound

What has happened over the last few years is that HF utility communications around the globe have evolved dramatically. There *was* a point in the middle of the last decade that the number of users of the HF radio spectrum declined, due to the migration to satellite systems and terrestrial radio repeaters. That did result in a dwindling interest in HF communications by many services around the globe in the middle to late 1990s. There was a perceptable decline in the number and types of signals that a monitor could hear on a hardware based digital decoder system. If you owned one of those older Universal M-7000 or similar hardware-based decoders, the world of radio gradually died and you no longer saw the activity you once did.

But, I can honestly say that this trend has reversed, and activity on the HF utility bands in this first decade of the 21st century is on the upswing. This is due in part to computer related technology advances, increasingly crowded space on satellite systems, and increased cost for terrestrial and satellite-based communications. Thanks to more robust and reliable digital systems, and tools such as Automatic Link Establishment (ALE), we have seen a renewed interest in HF as a viable and cost effective long range communications system.

While some of the older and more familiar services of previous decades may have left HF *en masse* (e.g., voice/CW marine, fixed point-to-point services, etc.), other services have now rushed in to fill the void left behind. These new services are using a wide variety of modes to pass along traffic, even using HF frequencies to send and receive email.

A longtime friend of this magazine, Joerg Klingenfuss, who has been beating the HF email drum for nearly a decade, says that "private radionets such as Sailmail and Globe Wireless offer inexpensive global radio connections, using state-of-the-art technologies such as PACTOR."

But the invasion of email services is not limited to just the private sector. Here in the United States various agencies of the federal government and the Department of Defense are generating email on some of their HF radio systems. Admittedly, the average monitor won't be able to decode most of those email messages due to encryption, but we can follow units that are sending this traffic, and understand any clear voice or digital communications that are carried on these network radio frequencies.

❖ Getting Started

To effectively monitor these systems, you will need an HF radio (preferably one that can be interfaced with a computer), a computer with a sound card, and some free software such as PC-ALE or Multipsk. The explosion of sound card modes developed by amateur radio operators, have now found a home on various government and military HF nets. So yes, you will have to get a computer to decode the activity on these services, but overall it will be cheaper than buying some of those old hardware-based decoders of years past and the ROM chips to keep them up-to-date.

The big digital mode catch word in all of this is ALE. It is the basis of a modern and effective monitoring post on HF radio frequencies. Details on setting up your shack to monitor ALE comms is outside the scope of this column, but you will find exactly what you need, including free software, at the HFLink website I have listed in my Milcom Resource Guide.

Table 1 is just a small sample of all the intercepts monitored here in Brasstown during a 21-day period shortly before the deadline of this column. We did not monitor every day during that 21-day time span and monitoring was concentrated primarily during daylight hours.

I have tagged each of the 120 frequencies presented in our list with the primary user of that frequency. Space constraints limit a complete list of all the station IDs for the ALE addresses below, so if you would like to decode all of the ALE addresses, we have available for sale our *International Callsign Directory* (details on availability in our resource guide). You can also checkout our online source, the *Milcom Monitoring Post,* where we have lists of various military and government HF radio networks and ALE station addresses.

The world of utility radio monitoring has changed and in order to continue to monitor that world, you have to change with it. It is actually simple to make that change, and if you do, you will be rewarded by a whole new world of radio listening that you have never experienced before.

Don't take the summer off for radio monitoring. It may be the best time to monitor HF military and government activity. No one knows what our hurricane season may bring, but if anything threatens the U.S., you can be sure that government and military communications will ramp up for it.

❖ Finally ....

A new, National Guard-style ALE address has surfaced on the HF bands. I still do not know the mission of these new units, but will continue to research several possibilities suggested by the addresses themselves.

As of press time I have monitored the following ALE stations: T13NGB1, T24JCCC1, T43DE1, T55WA2, T60TN1, T69ME1, T69ME2, T83ANG10, T86VA2

These new stations have been heard on the following frequencies: 4490.0, 5211.0, 6766.0 6800.0, 6985.0, 6997.0 (LSB) 7722.0, 9106.0, 10493.0, 10816.5, 11217.0, 11439.5, 11608.5 13242.0, 13568.0, 14396.5, 14653.0, 15094.0, 16338.5, 17458.5, 17487.0 kHz.

If anyone has any information to add on the nature of these new stations, please email me at the address in the masthead.

So, until next month, 73 and good hunting.

MILCOM RESOURCE GUIDE

HFLink - **http://hflink.com/**
Multipsk - **http://f6cte.free.fr/index_anglais.htm**
PC-ALE - **http://hflink.com/beta/**
International Callsign Directory - **www.groveent.com/callsign.html**
Milcom Monitoring Post - **http://mt-milcom.blogspot.com/**

TABLE 1: LIST OF RECENTLY MONITORED GOVERNMENT/MILITARY HF FREQUENCIES

2046.5 DoD Tri Service MARS ALE Net – KBPNNN WWLNNN

3204.0 Civil Air Patrol ALE Net – 0004IACAP 0011ARCAP 0032WVCAP 033NHQCAP 034MERCAP 043MERCAP 0112GACAP

3341.0 FEMA FNARS ALE Net – FC4FEM FC6FEM FC8 FC8FEM FC8FEM001 FC8FEM006 FR4FEM FR4FEM001

4477.0 Civil Air Patrol ALE Net – 032WVCAP 034MERCAP 040NHCAP 043MERCAP 060PCRCAP 100NCRCAP 0112GACAP 201SERCAP 202SERCAP AVS

4490.0 SHARES SCN ALE Net – 3PBAFA 4FNAFA 5QWAFA AAT3BF EBCNNN KBPNNN KFD906 KFW652 KGD825 KMN93 KNNP491WV KNY58 KNY72 KNY97 KNZ20 KOP629 OARNNN USDAEOC2 WWLNNN

4562.0 National Guard (VA) – AFF EMP FNK HAM IFR ONK PUL RLD RMD VAB

4603.0 FEMA FNARS ALE Net – AL4FEM FC1FEM FC4FEM FC4FEM002 FC5FEM FC6 FC6FEM FC8 FC8FEM FC8FEM006 FR4FEM TN4FEM VT1FEM

4721.0 USAF HF-GCS Scope Command ALE Net – ADW

4745.0 NIPRNet (Unclassified but Sensitive Internet Protocol Router Network) (formerly called the Non-Classified Internet Protocol Router Network) – OFFNPR

4780.0 FEMA FNARS ALE Net – FC4FEM002 FC8
National Guard (VA) – RLD

4790.0 National Guard (RI) – T1126

4912.0 US Army Aviation ALE Net – 248OPS IAASF2 R24412

4947.0 US Government, Unknown Agency – KLE439 KLE439B KLE444 KLE446 KLE449 KOP629

5006.0 Civil Air Patrol ALE Net – 004MERCAP 004MICAP 004SWRCAP 004WICAP 0011ARCAP 034MERCAP 043MERCAP 046NHQCAP 100NCRCAP 100PRCAP 100SWRCAP 101NCRCAP 101NERCAP 0112GACAP 202SERCAP 314MICAP 0602IACAP 952NHQCAP ADWCAP JNR OFF RIC

5125.0 National Guard (VA) – AFF HAM RLD

5135.0 Operation Secure Net – MA1NC SEMOHQ

5140.0 Operation Secure Net – MA1NC

5158.0 DoD Tri Service MARS ALE Net – 2PBAFA KBPNNN OARNNN WKCNNN WWLNNN

5211.0 FEMA FNARS ALE Network – RLD T24JCCC1 T43DE1 T60TN1 T69ME1 T86VA2

5236.0 SHARES Region I/II/III (Northeast RCS) Net – KOP629

5236.5 National Guard (MS) – T01185

5402.0 FEMA FNARS ALE Net – FC6 FC6FEM FC8 FC8FEM FC8FEM006 FH0 FR5FEM

5447.0 Civil Air Patrol ALE Net – 043MERCAP

5702.0 SIPRNet Secure Internet Protocol Router Net – OFFSPR

5708.0 USAF HF-GCS Scope Command ALE Net – ADW OFF

5711.0 SHARES SCN ALE Net – 90 AAT3BF KBPNNN KEY798 KTQ313 NNN0KEF ZLSNNN

5732.0 Cothen HF Net – A99 D31 D49 D70 FTMPRI J22 J39 J43 K63 LNT N04 VAI

5817.0 National Guard (VA) – AFF HAM RLD
National Guard (MS) – T01185

5820.0 US Government, Unknown Agency – 90

5821.0 FEMA FNARS ALE Net – FC8 FC8FEM FR5FEM

5821.5 National Guard – A3L H1M NGTROOPCMD

5877.0 National Guard – AFF HAM RLD

5909.5 CBP Communications Net: USCG & CBP Units, A25 D05 DENPRI DL1CBP J01 J27 J43 K53 LNT MEMPRI N03 N04 TSC TSCCBP

5961.0 FEMA FNARS ALE Net – FC8 FR5FEM

6715.0 SIPRNet Secure Internet Protocol Router Net – OFFSPR

6721.0 USAF HF-GCS Scope Command ALE Net – ADW JNR

6765.0 SHARES Region V/VII/VIII (North) Net – AAT3BF

6773.0 Civil Air Patrol ALE Net – 034MERCAP 043MERCAP

6800.0 SHARES SCN BBS Net – D70 T69ME2 T83ANG10

6806.0 Civil Air Patrol ALE Net – 004MERCAP 004WICAP 0011ARCAP 0011OKCAP 0032WICAP 0032WVCAP 033NHQCAP 034MERCAP 043MERCAP 046NHQCAP 047SERCAP 0048FLCAP 054NHQCAP 100SWRCAP 101NCRCAP 201SERCAP 202SERCAP 0314MICAP 0902ALCAP ADWCAP MCC RIC

6809.0 FEMA FNARS ALE Net – FC1FEM FC4FEM FC6 FC6FEM FC8FEM FR5FEM VA3FEM

6911.5 US Army/National Guard Aviation ALE Net – DKB KBDLNG

6985.0 US Army Command Emergency Operations/National Guard Net – F0171 T01185 T69ME1 USADA1010 USAIS1012

6997.0 National Guard – T69ME1 (LSB)

7348.0 FEMA FNARS ALE Net – 441FEMAUX FC1FEM FC4FEM FC6 FC6FEM FC8 FC8FEM FL4FEM FR4FEM FR5FEM IA7FEM MS4FEM NC4FEM SC4FEM VA3FEM

7361.5 National Guard – IAASF2 R23865

7428.0 FEMA FNARS ALE Net – FC4FEM002 FC6 FC6FEM002 FC8FEM002 FC8FEM006 FR5FEM

7477.0 Operation Secure Net – RACES4 SEMOHQ SEMO01SEMO02 SEMO03 SEMO05 VA78CTSCSP

7527.0 Cothen HF Net – 720 A99 D31 D49 I1L I52 J03 J10 J19 J22 J39 J43 K63 LNT N04 N07 OPB T85 TSC

7642.0 DoD Tri Service MARS ALE Net – 3PBAFA AAR2AN EBCNNN KBPNNN OARNNN WKCNNN WWLNNN ZLSNNN

7650.0 National Guard – IAASF2 NGTROOPCMD R24412

7720.0 National Guard – T55WA2

7802.0 Operation Secure Net – 048 252 D12ISP M42 M48 TLWY1

7805.0 Operation Secure Net – 2104CTSCSP MA1NC NA1SH VA78CTSCSP

7932.0 Operation Secure Net – MA1NC NA1SH

8012.0 Civil Air Patrol ALE Net – 001OKCAP 0004NVCAP 0004WICAP 004MERCAP 0011ARCAP 0020NHCAP 034MERCAP 040NHQCAP 0042NHCAP 043MERCAP 044NCRCAP 0048FLCAP 0054NHQCAP 060PCRCAP 100SWRCAP 101NCRCAP 0140NVCAP 202SER CAP 0314MICAP 0355OKCAP 0431ILCAP 0775NVCAP 0902ALCAP 9101ORCAP FR5FEM RIC

8047.0 National Guard (VA) – HAM

8050.0 US Army – DKB PMHUNG
FEMA FNARS ALE Net – FC8 FC8FEM FR5FEM PASFEM PASTOR PASTOR2 PASTOR5 PISTON WI5FEM

8161.5 National Guard – KBDLNG

8171.5 US Army/National Guard – A3L S2L

8181.5 National Guard (RI) – T1126

8912.0 Cothen HF Net – 501 720 D05 D31 D49 D70 I00 I1L I43 J27 LNT MV4 N04 T85

8965.0 NIPRNet (Unclassified but Sensitive Internet Protocol Router Network) (formerly called the Non-Classified Internet Protocol Router Network) – OFFNPR

8968.0 SIPRNet Secure Internet Protocol Router Net – MCCSPR OFFSPR

9019.0 UK DHFCS TASCOMM ALE Net – XSS

9025.0 USAF HF-GCS Scope Command ALE Net – 140060 255145 ADW MCC MOBD02 OFF

9047.0 Civil Air Patrol ALE Net – 0004IACAP 004MERCAP 004NVCAP 004SWRCAP 004WICAP 0010NVCAP 011ARCAP 0034MERCAP 0041CTCAP 0043MERCAP 0431ILCAP 0048FLCAP 054NHQCAP 094ALCAP 100NCRCAP 100NDCAP 100SWRCAP 101NCRCAP 112GACAP 0140NVCAP 201SERCAP 0775NVCAP AVS

9064.0 SHARES Region X (Northwest RCS) Net, National Night Alternate – OPMHQ1

9081.5 US Army/National Guard – IAASF2 R24412

9106.0 SHARES SCN ALE Net – 3PBAFA 5QWAFA 034MERCAP 050NCS 82KNY 87KNY AAT3BF AFA2PB AQPNNN BF741 KBPNNN KFW652 KMN93 KNY58 KNY70 KNY85 KNY86 KNY87 KNY91 KTQ313 OARNNN SEJNNN T69ME1 USARC5 WNG930 WWLNNN

9224.0 DoD Tri Service MARS ALE Net – 3PBAFA 6HSAFA AAR2AN AQPNNN EBCNNN JFKNNN KBPNNN OARNNN WKCNNN WWLNNN

9462.0 FEMA FNARS ALE Net – CT1FEM FC1FEM FC4FEM FC6 FC6FEM FC8 FC8FEM FC8FEM006 FCS FL4FEM MA1FEM MS4FEM NJ2FEM PASFEM PASTOR2 SC4FEM T69ME1 VA3FEM VT1FEM

10194.0 FEMA FNARS ALE Net – 460FEMAUX 473FEMAUX AZ9FEM CO8FEM FC1FEM FC4FEM FC6 FC6FEM FC8 FC8FEM FC8FEM006 FC0FEM FR4FEM FR5FEM KY4FEM MT8FEM NE7FEM T69ME1 UT8FEM VA3FEM VT1FEM

10202.0 National Public Health Radio Network – KGD825

10493.0 FEMA FNARS ALE Net – T13NGB1 T69ME1 T69ME2 T83ANG10

10588.0 FEMA FNARS ALE Net – FC1FEM FC4FEM FC6 FC6FEM FC8 FC8FEM FC8FEM006 FC0FEM FCSFEM FCSFEM010 FM6FEM4A FR4FEM FR5FEM IA7FEM

10670.5 National Guard (MS) – T01185

10816.5 National Guard – HQ701N M010EN T69ME1

10818.0 US Army – C1C

10821.0 National Guard (RI) – T1126

10899.0 FEMA FNARS ALE Net – FC6FEM002 FC8FEM FC8FEM002

11098.5 DoD Tri Service MARS ALE Net – 3PBAFA AAR2AN

11108.0 FEMA FNARS ALE Net – FC6 FC6FEM FC8 FC8FEM

11181.0 SIPRNet Secure Internet Protocol Router Net – CROSPR OFFSPR

11217.0 SHARES SCN ALE Net – 043NCS AAT3BF PR011 PR015 T69ME1 USARC5
UK DHFCS TASCOMM ALE Net – XSS

11226.0 USAF HF-GCS Scope Command ALE Net – 140060 160023 CRO OFF

11439.5 National Guard – T13NGB1 T69ME1

11494.0 Cothen HF Net – D05 D31 D46 D49 D70 J03 K01 T42 T85 TRK

11608.5 National Guard – T43DE1 T69ME1

12087.0 National Guard STARC Nationwide Net – HQ703N M050NN

12129.0 US Army/National Guard – A3L
FEMA FNARS ALE Net – FC4FEM002 FC6FEM002 FC8FEM002

12216.0 FEMA FNARS ALE Net – FC1FEM FC6 FC8 FC8FEM FC8FEM006 FC0FEM FM6FEM4A FM0FEM4C FR3FEM FR5FEM NM6FEM VA3FEM

12222.0 CBP Communications Net: USCG & CBP Units – A48 D31 D45 D46 D48 D70 EST I3L I43 I52 J40 J42 K61 K72 LNT N03 N04 VAI

12270.0 FEMA FNARS ALE Net – FC1 FM9FEM

13215.0 USAF HF-GCS Scope Command ALE Net – 160023 CRO ICZ PLA

13242.0 NIPRNet (Unclassified but Sensitive Internet Protocol Router Network) (formerly called the Non-Classified Internet Protocol Router Network) – OFFNPR T69ME1

13312.0 CBP Communications Net: USCG & CBP Units – D46 D70 I52 D70 MR1

13446.0 FEMA FNARS ALE Net – FC1FEM FC4FEM FC6 FC6FEM FC8 FC8FEM FC8FEM006 FC0 FR5FEM IN5FEM MN5FEM NM6FEM SL0 VA3FEM

13568.0 National Guard STARC Nationwide Net – M010EN N010HN T69ME1

13894.0 FEMA FNARS ALE Net – FC1 FC6FEM002 FC8 FC8FEM002 (replaced 13744.0 kHz)

13907.0 Cothen HF Net – 716 720 A48 A99 D07 D49 D70 F29 I37 I52 J03 VAI

14396.5 SHARES <Primary> – T69ME1

14450.0 FEMA FNARS ALE Net – FC6 FC6FEM FC8FEM006

14582.0 CBP Communications Net: USCG & CBP Units – D46

14653.0 National Guard STARC Nationwide Net – HQ701N M010EN N010HN T69ME1

14776.0 FEMA FNARS ALE Net – FC6 FC6FEM FC8 FC8FEM FC8FEM006 FC8FEM010 FC0 FC0FEM FCS MN5FEM MT8FEM OR0FEM

14885.0 FEMA FNARS ALE Net – FC6FEM FC8

15043.0 USAF HF-GCS Scope Command ALE Net – CRO HIK

15091.0 SIPRNet Secure Internet Protocol Router Net – CROSPR

15094.0 SHARES SCN ALE Net – T69ME1

15708.0 FEMA FNARS ALE Net – FC8 FC8FEM FC8FEM006 HI9FEM

15867.0 Cothen HF Net – 716 D70 I96 PAC

16201.0 FEMA FNARS ALE Net – FC8

17519.0 FEMA FNARS ALE Net – 460FEMAUX AK0FEM FC0FEM

17976.0 SIPRNet Secure Internet Protocol Router Net – CROSPR HAWSPR ICZSPR JNRSPR PLASPR

18003.0 USAF HF-GCS Scope Command ALE Net – 280055 HIK ICZ PLA

18594.0 Cothen HF Net – D49 D70 T97

19969.0 FEMA FNARS ALE Net – FC1FEM

20890.0 Cothen HF Net – D49 D70

21866.0 FEMA FNARS ALE Net – FC1FEM

BROADCAST BANDSCAN

THE WORLD OF DOMESTIC BROADCASTING

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Going, going, gone...

Last time, I wrote about two large Canadian AM stations disappearing. Two months later, they're still gone, with no sign of anyone else taking over their frequencies. But in a more dramatic move, Mexico is trying to move all their AM stations to FM!

The government plans to roll out the AM-to-FM moves in geographic regions, starting in southeastern Mexico. A list of available FM frequencies is to be published; AM stations will have a few days to apply for the available frequencies. A spectrum fee, to be determined, may be charged. After an FM permit is issued, the station may simulcast on AM and FM for up to a year, after which the AM license is to be canceled. If sufficient FM frequencies are not available, frequencies will be allotted in order to maximize the number of AM operations allowed to move.

In an article in *Radio World*, Mexican broadcaster Roque Chavez said he could see most of Mexico's AM stations moving to FM by 2015.

In justifying the AM-to-FM moves, the government cites the same reasons we're seeing in the U.S. and Canada: electrical interference and the need for stations to reduce power at night to avoid interference. The government decision states that, of Mexico's 854 AM stations, 701 must reduce power at night and another 96 must go off the air completely. As in the U.S., AM's market share is also shrinking in Mexico. From 92% of the audience in 1972, AM's audience share has shrunk to 17%.

The Mexican government also believes the eventual digitalization of the country's radio broadcasts requires a move to FM first. They do not seem interested in AM-IBOC. The government statement notes the problems of nighttime skywave interference. They also note that while AM-IBOC lifts the audio quality of AM radio to something similar to analog FM; FM-IBOC lifts it to a level similar to that of a CD – or allows transmission of multiple programs on the same frequency.

When will Mexican AM stations start disappearing? That's a good question. It might be a good idea to brush up on your Spanish and log those south-of-the-border stations while they still exist.

Meanwhile, *north* of the border...

The digital TV transition has been postponed, indefinitely, in rural Canada. The Canadian Radio-television and Telecommunications Commission (CRTC) will still require stations in "mandatory markets" to convert to digital by the end of August 2011, but stations elsewhere in the country may continue in analog if they choose. The CRTC *encourages* these stations to convert, but will not *require* it.

"Mandatory markets" are:

The 13 provincial and territorial capitals;
Markets with a population in excess of 300,000; and
Markets with more than one locally-based station.

And here in the States

When two or more firms apply for mutually-exclusive new commercial broadcast stations, Congress requires the FCC to hold an auction to determine who gets the permit. A series of auctions will be held next month for this purpose.

Three AM permits are up for grabs. There are two applicants for 750 kHz near Ithaca, New York. Two frequencies are being auctioned in Terre Haute, Indiana; 640 and 1230. The former has seven applicants and the latter six. Both Indiana frequencies are available after the former licensee lost his stations as a result of being convicted of serious felonies in state court. An FM frequency (107.5) was also lost in Terre Haute. This frequency has been reserved for non-commercial operation; twelve applications have been filed. Non-commercial frequencies do not go to auction. The July auctions will also assign 13 commercial FM permits and two commercial FM translators.

The FCC has decided to limit downgrades to AM permittees who win their permits through a promise of superior service. When two or more applicants propose mutually-exclusive AM facilities, applicants whose stations would serve more people receive preference. However, right now there's nothing to prevent you from proposing high power to win the permit – and then modifying the permit to reduce power, even below what one of the other applicants proposed.

Obviously the Commission feels this is an unfair situation! They have decided that an applicant who wins an AM permit as the result of proposing larger coverage must serve at least 80% of the originally-proposed population for at least four years. They will also be prohibited from changing their city-of-license for this four-year period.

Note that permits have been granted for six new stations this month. Many of these are not in out-of-the-way places; we have permits near Fresno; near Minneapolis; near Tacoma; and in Billings, Montana. And, we have a permit for a second expanded-band station in the U.S. Virgin Islands. Assuming this station is built, it should make the Virgin Islands a lot easier to log (especially for those whose reception of the other V.I. station, WDHP-1620, is blocked by local interference).

❖ TV odds & ends

Back in April, I noted the FCC denied a proposal to move two TV stations from the West to New Jersey and Delaware, essentially creating new stations in New York and Philadelphia. At the same time, the Commission felt an Act of Congress did require them to allot a VHF channel to New Jersey. They have now done so, allotting channel 4 to Atlantic City. Somewhat to my surprise, there were no counterproposals. A proposal to allot channel 5 to Seaford, Delaware is still pending.

Channel 37 is reserved for radio astronomy. FCC regulation 74.702(2) places this channel off-limits for low-power stations. (A separate rule prohibits use of channel 37 by full-power stations.) In a recent filing window for new low-power stations, four applicants seemed to miss this regulation, filing for operation on the unusable channel. One application was granted! KAGN-LP Crowley, Louisiana briefly had permission to operate a digital facility on channel 37. This permit was promptly rescinded once the mistake was noted, and three other applications for channel 37 were dismissed.

From the beginning of UHF in 1952 through the dawn of the cellphone in 1983, the TV band ran from channel 2 through channel 83. It shrunk to 2-69 when phones took over the top 13 channels, and again to 2-51 last June, when full-power analog TV came to an end. Now, a proposal has been filed to shrink the band even further.

A Commission task force found that auctions in 2008, distributing channels 52-69 for non-TV use, retrieved an average of $1.28 per MHz of spectrum per person reached. TV spectrum auctions have returned roughly 10% of that figure.

The task force made a number of proposals to "pack" TV assignments further, potentially allowing the removal of channels 46-51. They propose to allow stations to voluntarily surrender their spectrum in return for a cut of the revenue that spectrum retrieves at auction. Stations may be required to switch from the current "one large transmitter" coverage model to the use of a group of smaller transmitters. They have even discussed requiring stations to share channels.

❖ FM & TV skip season

We're just entering the skip season. The long-distance VHF propagation is going to be a bit more difficult to spot this year. Of course, the full-power U.S. analog signals went away last July. Low-power analog signals remain, as do a handful of full-power U.S. digital signals. KNOP 2 (Nebraska); KOTA 2 & KDLO 3 (South Dakota); WBRA 3 (Virginia); KHAS 5 (Nebraska); and WTVF 5 here in Nashville seem to be the most-seen digital skip signals.

If you see a digital skip signal on channel 4, you can reasonably assume it's WHBF in the Quad Cities – the only other authorized full-power digital station, KSNB in Nebraska, is off the air. Last year, DXers also reported a bumper crop of foreign stations. Cuba, Mexico, and Canada made for most loggings. A few more exotic locales, like Colombia, were reported.

❖ Letters from Listeners

Tim O'Hare in Spokane is hearing digital signals on 580 and 600 kHz. He says they "sound just like the digital sigs you run into on the SW spectrum." Tim's using an Icom R-75; he's also hearing these signals on a Grundig portable.

Digital signals on shortwave come in a wide variety of flavors. I suspect Tim is hearing a rushing noise, and if so I think I know where it's coming from. There's a local station, KQNT, on 590 in Spokane – and according to the station's Wikipedia page, they use HD Radio. The HD radio sidebands for KQNT would extend from 575-585 and from 595-605 kHz.

My mention of 1660 kHz in the "Twenty Years of DX" column triggered a response from John Schmelzer of St. Louis. He finds KXTR Kansas City, on that frequency, to be the most interesting AM station he knows of. Ironically, KXTR was blasting in on the car radio as I took the photos of WMRO-1560 that appear in this month's column.

The WMRO-1560 building, near Gallatin, Tennessee.

KXTR is certainly the *largest* classical music station on AM. But it's not the only one! WCCC-1290 in West Hartford, Connecticut is still running classical music on AM as well. Off the top of my head, I can't think of any more. But I'm sure you readers will prove me wrong!

(John also mentions WQXR-1560 New York, which was America's most powerful AM classical station for many years. He believes the classical music on WQXR AM is gone, and he's right. The station is now Radio Disney.)

Unfortunately June is almost exactly the wrong season for it, but John mentions wintertime daytime skywave reception. Occasionally, long-haul AM reception is possible all day long. One day last December, KQWB-1660 Fargo, North Dakota showed up in St. Louis – with a program reminiscing about northwest Minnesota dumps and incinerators!

WMRO-1560 uses a "folded unipole" antenna, with loading wires parallel to the tower.

❖ 'Til next month

Have you tried targeting your old hometown for DX loggings? Have you had any success? Write me at 7540 Highway 64 West, Brasstown NC 28902-0098, or by email to dougsmith@monitoringtimes.com. Good DX!

URLs in this month's column:

http://americanbandscan.blogspot.com My DX blog

www.facebook.com/pages/South-Boston-VA/WAJL-Radio/406889170111 WAJL-1400's Facebook page

www.newstalk590.com/ KQNT-590, the likely source of Tim O'Hare's digital signals

www.radioworld.com/article/80078 *Radio World* item on Mexican government plans to move the country's AM stations to FM

www.beethoven.com/ WCCC-1290, one of two AM classical music stations in the U.S.

AMERICAN BANDSCAN STATION REPORT

NEW:

New stations on the air

South Boston, Virginia	1400	WAJL	1,000/1,000 ND (southern gospel)

Permits granted for new stations:

Easton, California	1150	260/5,000 DA-N (east side of Fresno)
Captain Cook, Hawaii	1150	5,000/5,000 ND (western shore of the Big Island)
Chanhassen, Minnesota	1200	1,300/1,000 DA-N (Chanhassen is a Minneapolis suburb)
Billings, Montana	1600	5,000/1,250 DA-N
Charlotte Amalie, USVI	1690	920/920 ND
Yelm, Washington	1120	10,000/6,000 DA-1 (near Tacoma)

New-station applications dismissed:

Taylor, Alabama	1400

CHANGES:

Callsign changes:

Birmingham, Alabama	690	WJOX	from WSPZ
Dothan, Alabama	700	WCNF	from WEEL
Pike Road, Alabama	1210	WTXK	from WQLS
Cathedral City, Calif.	1340	KWXY	from KPTR
Palm Springs, Calif.	1450	KPTR	from KWXY
Twin Falls, Idaho	1270	KPDA	from KTFI
New Castle, Indiana	1550	WLTI	from WMDH
Boone, Iowa	1260	KTIA	from KFFF
Silver Spring, Md.	1050	WTOP	from WZAA
Everett, Massachusetts	1430	WKOX	from WXKS
Newton, Massachusetts	1200	WXKS	from WKOX
Syracuse, New York	1260	WSKO	from WNSS
Raleigh, North Carolina	850	WKIX	from WRBZ
Shelby, North Carolina	1390	WOHS	from WADA
Cincinnati, Ohio	1480	WDJO	from WCIN
Huntingdon, Penna.	1150	WLLI	from WHUN
Sioux Falls, S. Dakota	1520	KZOY	from KSQB
Cookeville, Tennessee	780	WPTN	from WHUB
Cookeville, Tennessee	1400	WHUB	from WPTN
Humboldt, Tennessee	1190	WHUN	from WLLI
Spring City, Tennessee	970	WRHA	from WXQK

Frequency changes requested:

Pensacola, Florida	780	WPNN	from 790; from 1,000 watts to 3,000.
Isleta, New Mexico	1510	KABR	from 1500; from 1,000 watts to 5,000.

KABR wishes to move from western New Mexico to just south of Albuquerque.

Frequency changes on the air:

Waynesburg, Penna.	1210	WANB	moved from 1580; power from 720 watts to 5,000.

ND: non-directional
DA-N: directional at night only
DA-D: directional during daytime only
DA-2: directional all hours, two different patterns
DA-3: directional day, night and critical hours, three different patterns

BOATS, PLANES, AND TRAINS

TRAINS

Ernest Robl
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Railroads Reliant on a Variety of Radio Uses

Last time we looked at how the use of radio code line (RCL) for transmission of signal data between dispatchers and field locations lets us listen in on this data and view it on a display similar to that used by dispatchers. I mentioned that I was still gaining experience with ATCSM (ATCS Monitor), the program that decodes the data transmissions.

Some of my experience has come from watching ATCSM dispatcher displays showing trains progressing along a line with which I am familiar; the rest has come from reading most of the posts in the ATCSM online discussion group. I'll get back to that in a moment.

As I learned about RCL and how railroads use it – ATCS is actually a shorthand term for a whole collection of related data communication protocols, rather than a single absolute standard – I also learned each railroad implements these protocols slightly differently. Sometimes the implementations are even different at different locations on the same railroad, because different predecessor railroads that merged into the present-day railroad each had their own standards.

That also means that how these railroads implement RCL at a given location affects what ATCSM can display for us. More on that later, too.

For now, I want to point out that, if you are willing to delve into the technical details of ATCSM, you can add scripts to the program that will initiate actions on your computer when ATCSM receives a particular data message. One example of this is that you can tell your computer to play a sound when the status of a particular track segment goes to occupied.

❖ Respect

Watching the discussions on the ATCSM online discussion group has given me respect for the tremendous amount of work required to fully "map" a given line. Someone has to physically travel the line, identify the control points, determine what they are broadcasting (and on what frequencies), and then to determine what these data packets really mean.

(Last time, I mentioned that if you want to do field monitoring of ATCSM, you need two receivers – one for listening to voice transmissions, the other for the data packets. Actually, you may need three receivers, as the inbound and outbound data packets are usually on different frequencies. ATCSM can receive data from multiple inputs for field monitoring.)

The discussion on the ATCSM list ranges from the very basic – "I've installed ATCSM on my computer and can't get it to work" – to quite technical matters. Yes, most of the experts on this list, people who don't necessarily work in the fields of railroad signaling and dispatching, but who still have great understandings of both these fields and radio communications, also have tremendous patience with even simple questions. Often it becomes clear that that some new members of the group simply have not read even the basic introductory documentation for ATCSM.

These "old hands" on the ATCSM list, including the author of ATCSM, will try to help you, but you need to provide more information, beyond the fact that you cannot get ATCSM to work on your computer.

❖ Stepping back

Thinking about ATCSM brought to mind just how dependent today's railroads are on a wide variety of radio communications. Those monitoring two-way radio voice communications are familiar with engine- (and vehicle-) mounted and hand-held radios which allow crew members to talk to each other and to dispatchers. These messages and the information they contain are the backbone of railroad operations, without which most moves from switching to long-distance runs would be a lot more difficult – and more dangerous.

Wayside scanning equipment for reading RF tags on railcars and locomotives. The small box on the inverted L-shaped arm is the transmitter. The larger antenna on the vertical post reads the signals that are returned. The angle of the photo makes it look like the transmitter unit is between the rails. It is not.

But railroads are also very dependent on data communications. Two of the most obvious are end of train (EOT) devices (sometimes also called FREDs, for flashing rear-end devices) which communicate brake line pressure from the back of the train to the locomotive and remote control of locomotives.

Dual action EOTs can not only send data, but they also receive commands which can initiate an emergency brake application. Initiating an emergency brake only from the locomotive means that the brake application signal travels down the train as brake pressure is reduced in the brake air line in each car. That takes time – and it means that the front of the train is braking hard while brakes are not yet applied on the rear of the train. In hilly or curving terrain, this is extremely dangerous as the momentum of the (yet) unbraked rear portion of the train is pushing on the front, possibly causing a derailment in a worst-case situation.

Triggering an emergency brake application from the rear of the train at the same time as it is implemented at the front slows the train down faster and gives the engineer more control over the train.

By the way, the device on the locomotive that communicates with the EOT or FRED is often called a "Mary." It doesn't stand for anything. Crews just thought it was a nice complimentary name to FRED – and it stuck.

You can listen for the chirps of the data packets being sent from the EOT or FRED – which will alert you to the presence of a train, even if no voice communication is taking place.

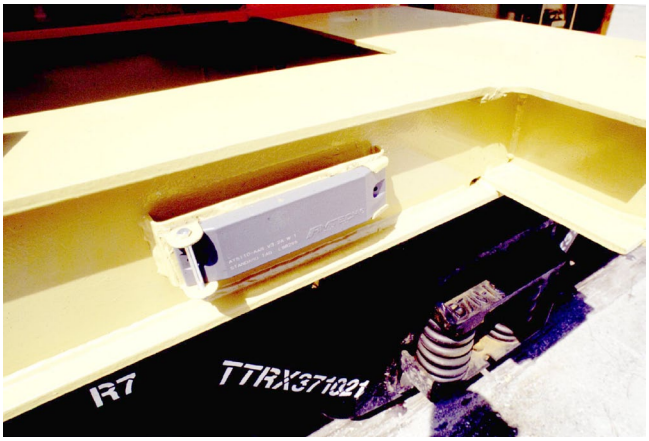
❖ Remote control

Remote control of locomotives takes two basic forms – and both have been around for some time, though the equipment has become more sophisticated and reliable:

Control of locomotives for switching moves, and

Control of additional locomotives spaced throughout a long train.

Remote control of switching locomotives has been used for both safety and labor-saving reasons. The remote control can take place either from a central point, often by an opera-



Radio Frequency (RF) ID tag on railroad intermodal spine car. These tags are inert in the sense that they do not have their own power source, Rather, when they are subject to a strong radio interrogation signal, they transmit the data that is stored in them, allowing the movement of cars and locomotives past a given point to be recorded and transmitted to railroad operation centers.

tor located at a high vantage point, such as in a control tower or from a belt-pack unit worn by an operator on the ground.

Often, the crewman with the belt-pack control unit on the ground has better visibility for a particular switching move than if he (or she) were riding in the cab of the locomotive – particularly if the locomotive is pushing a string of cars. If needed, however, the operator can ride on the outside platform of the locomotive while operating the locomotive. Or, for longer moves between switching locations, the operator can transfer control back to the cab of the locomotive.

While in some cases there are advantages to the operator having a first-hand view of a move, rather than having a second crewman call out instructions over a voice radio, there are, of course, also other dangers associated with remote control. Most locations where remote control switching locomotives are in use have prominent warning signs about these operations. And, most remote control units worn by the operator have safeguards, including orientation sensors. If the unit is not upright, indicating that the operator has fallen or become disabled, an emergency brake application takes place immediately.

Remote switching started at industrial sites, such as mines, but is now also used in yards of some major railroads.

Unmanned remotely controlled locomotives used in long-distance freight trains are usually called DPUs, or distributed power units. On most lines without steep grades, a DPU is placed at the rear of the train, where it is easy to add or remove, as needed – though now DPUs generally stay with their trains for their entire cross-country journey. Particularly in mountainous terrain, a heavy train may have one or more sets of DPU engines spliced into the middle of the train.

Like EOTs, DPUs increase control of the train, allowing brake applications to be made at multiple locations throughout a train. Tractive effort is also better distributed. And, unlike EOT's which can only make an emergency brake application, DPUs can make the same gradual brake applications and releases as are possible from the front engine.

Most often DPU units are set up to simply echo the commands the engineer gives to the lead engines. But, the engineer can also issue different commands to the DPUs to have them perform different actions from what the front units are doing. For example, as a train crests a steep hill and the front begins to head downhill, the engineer can have the front units cut back to idle or even go into dynamic braking, while a rear DPU is still running a full throttle to get the rear of the train up the hill.

Most modern road locomotives are now equipped to operate as either a master unit or DPU. If you have two DPU units next to each other, only one needs to be able to receive the remote commands; the other unit gets its control commands from the MU (multiple unit) cable of the first DPU, the same as multiple engines at the front of a train.

More than that, every piece of equipment used in interchange service, including locomotives and freight cars, now has to be equipped with an electronic tag that is read by lineside scanners to track equipment and to verify equipment consists. Yes, you can buy a hand-held scanner to read these tags – check for ads in railroad trade publications – but these are very expensive.

❖ Back to ATCSM

Earlier, I mentioned that what you see on ATCSM dispatcher displays depends in part on how a specific railroad implements its radio code line and signal system. One difference is whether or not the display shows "route locked" and "out of correspondence" indications.

A route lock is a little red box over a switch showing that the switch is electrically locked for a particular route. That lock can be canceled only by the train passing the switch or the dispatcher running a time-delayed override. Once a route is lined and locked, it cannot be changed instantly by the dispatcher for an obvious reason: You do not want to throw a switch under a moving train. And, you do not want a train moving on a clear signal indication to suddenly get a red stop indication. So, dissolving a route is a process with built-in time delays (and checks for track occupancy), which first gradually resets signals to prevent a train from entering the switch, then unlocks the switch to allow a new route to be established.

"Out of correspondence" is a term you may also hear in voice communications between dispatchers and signal maintainers – and it's a term that goes way back to hard-wired dispatching consoles from the early days of centralized traffic control (CTC). ATCSM shows out of correspondence with a blue box over the switch or a blinking signal icon.

Out of correspondence means that the dispatcher is getting an indication that the situation in the field does not match what the dispatcher is requesting the signal system to do. When a dispatcher lines a route that requires moving one or more switches and setting signals, he will first get an out of correspondence indication for those signals and switches. That means that what his end of the signal system wants has not yet been put into effect, while the field equipment checks track occupancy and, if otherwise permissible, moves the switch(es).

But, that out of correspondence indication (given on old hard-wired dispatching boards with an actual indicator light) should clear quickly. If a switch still gives an out of correspondence indication a minute or more after the dispatcher tried to line it, that's an indication that there is something wrong in the field. Possibly the switch motor has failed or that there is some obstructing object that is prevent the switch points from being moved into the proper position and locked.

An out of correspondence indication for a signal, after the proper time has elapsed, may indicate that the field equipment is unable to communicate with the signal. That's when a signal maintainer gets a call to check out the equipment.

❖ More on meets

I've devoted much of a previous column to the subject of meets – how and where trains get past each other. Let's discuss a couple of additional terms related to meets.

A "running meet" is the holy grail of dispatching and train operations. That's when two trains get past each other without either one having to stop. While simple on double track, it's basically impossible with very short sidings. But, with sidings perhaps two or three times the length of either trains (or shorter sections of double track), it does become possible, though it usually requires some coordination between the trains involved and lucky timing.

(Anything over three to five miles of two parallel tracks is usually considered a short section of double track, rather than a siding, particularly if both tracks are build to full mainline standards.)

What's the advantage of a running meet? It saves fuel and time. Once a train is stopped, it takes time to restore full air pressure to the entire train – and without that full air pressure in the braking system, it is not safe to begin moving. A running meet also minimizes the time that any grade crossings within the span of the siding are blocked to vehicle traffic.

Two trains approaching a meet in a two- to three-mile siding are usually within radio range of each other and can coordinate the meet by having one or both trains adjust their speeds slightly. Of course, you also need the signal system to reverse the switches at each end of the siding as soon as each train has cleared.

Finally, the one kind of meet that railroads want to avoid at all costs is a "cornfield meet." That's railroad slang for a head-on collision.

BELOW 500 kHz

DXING THE BASEMENT BAND

Kevin Carey, WB2QMY
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Broadband Loops: Let's Build One!

Last month I gave a brief description of a new antenna I'm building – a single-turn, broadband (40-500 kHz) loop. There was interest from many readers in building such an antenna – either for improved DX performance, or interference reduction in noisy environments. Beginning this month, I will cover the steps I go through to build this directional antenna.

The loop is described in full at the website **http://tinyurl.com/ygt39z7** authored by Steve McDonald, VE7SL (BC). Courtesy of Steve, we will use some images from the site to explain the construction steps. My purpose here is not to duplicate what is already available online, but to chronicle my own experience in building and using the antenna. If you'd like to follow along, you can build one too!

Why *This* Loop?

I was drawn to this antenna for three main reasons. First, it covers a very wide frequency range without the need for retuning the antenna as one moves across the LW band. While remote tuning of loops is certainly possible, such arrangements can be fraught with difficulties when it comes to tracking, weather resistance, and the additional control cabling needed.

Second, a single-turn loop is a robust design, mechanically speaking. It can be mounted outdoors on a mast and turned with a standard TV-type rotator. Traditional multi-turn loops could technically be mounted in the same manner, but the increased surface area and delicate windings would probably not last long in an outdoor environment, certainly not in the northeast U.S. where I hail from!

Finally, the loop and its associated circuitry have a low parts count and can be easily constructed by the average home builder. The parts required are easily obtained from most electronics parts distributors.

Progress So Far

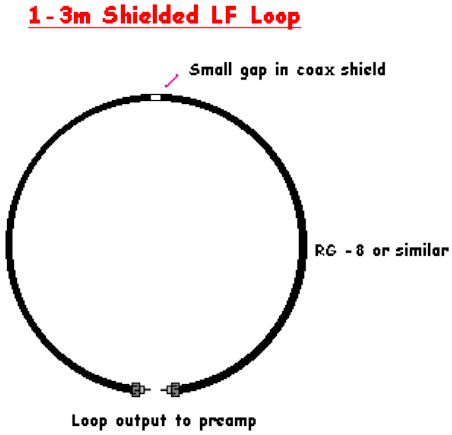
The first order of business was to decide on the *size* of the loop. The plans call for a diameter anywhere between 1 and 3 meters. Being my first such loop, I thought I'd keep it on the smaller side, and settled on 1-meter diameter (about 39 inches). I can always build a bigger loop later, if I choose – the exact size is not critical.

Either traditional coaxial cable (such as RG-8) or aluminum-shielded "hardline" coax can be used to form the loop. I chose 1/2-inch hardline, as it requires no support frame. Odd lengths of hardline can often be found at hamfests or by asking around in the VHF/UHF ham crowd. (If you choose to use flexible coax, a simple support frame is shown on the website.)

I formed the hardline into a circle that was as perfectly round as I could manage. Next, I proceeded to remove about 1 inch of the metal shielding at the top of the loop using a tubing cutter and hacksaw. First, I cut the shield in two places with the tubing cutter, and then used a hacksaw to carefully make a "spiral" cut across the small piece to be removed. I did my best not to damage the insulating foam beneath it.

With the spiral cut finished, I simply "peeled" this section away from the cable with needle-nosed pliers, and discarded it. I believe the whole operation could be accomplished using just a hacksaw, if done carefully.

It is important that the shield gap be located as near as possible to the physical center of the loop for symmetry (equal directional response heading). I made the gap weather tight by wrapping it with a few layers of black electrical tape. Figure 1 shows a view of the loop element with the gap at the top.

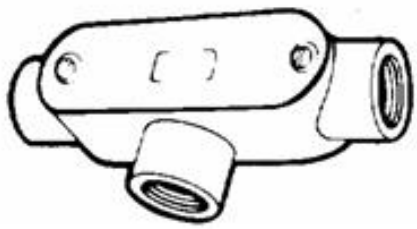


Preamp Enclosure

Note that Figure 1 shows RF connectors on each end of the loop for connection to the preamplifier circuit (to be built later). The preamp will be housed in a small box at the bottom of the loop.

Using connectors is an excellent idea, but for simplicity sake and for improved weather resistance, I plan to attach the center conductors of the loop ends to the preamp board via small pieces of flexible wire. I'll then use a liberal amount of silicone sealer at the entrance points of the enclosure to make it weather tight.

For my enclosure, I plan to use a T-style *conduit body*, available at most home centers (see Figure 2). The use of a *metallic* box is important for RF shielding. The box can be



fitted with clamps at each end for securing the hardline, and a gasketed cover for interior access.

That's as far as we'll go this month. Next time, we'll show the attachment of the loop to the conduit body, and discuss the preamp circuit, which can be built from easily obtained parts.

If you want a head start, you can begin gathering the rest of the materials you'll need: PVC pipe (for mounting mast), hardware, electronic components for the preamp and coupler unit, feedline, etc. See the VE7SL website for details on these materials.

❖ Loggings

My thanks to **Dick Palmer, W7KAM (AZ)** for his loggings this month (see Table 1). Dick uses an Icom IC-R75 receiver with an active antenna up 13 feet at the base. He adds that he received three QSLs in April, bringing his life total to 1010 verified.

TABLE 1. SELECTED LOGGINGS FROM AZ

FREQ	ID	ST/PR/ITU	CITY
201	YVZ	ON	Deer Lake
208	YSK	NU	Sanikiluaq
217	RI	WY	Riverton
219	GAV	AK	Gustavus
233	ALJ	AK	Johnstone Point
236	HQ	WA	Hoquiam
238	KT	NZL	Kaitaia
240	BVS	WA	Burlington
260	BYN	OH	Bryan
260	JYG	MN	St. James
260	NF	NFK	Norfolk Island
270	FA	SMO	Apia Faleolo
274	FR	NT	Fort Resolution
276	3H	AB	Consort
283	DUT	AK	Dutch Harbor
302	XY	YT	Whitehorse
329	YEK	NU	Arviat
332	POA	HI	Pahoa
333	AA	OCE	Anaa
335	CV	NM	Clovis
341	DB	YT	Burwash Landing
344	ZIY	CYM	George Town
352	RG	CKH	Rarotonga
353	LLD	HI	Lanai
356	ZF	NT	Yellowknife
365	DPY	WA	Deer Park
365	MA	YT	Mayo

375	FS	NT	Fort Simpson
376	ZIN	BAH	Great Inaugua
385	EHM	AK	Cape Newenham
385	EMR	GA	Augusta
386	4N	MB	Oxford House
387	SPP	CLM	San Andres Is.
390	BR	IA	Burlington
390	HBT	AK	Sand Point
390	JT	NL	Stephenville
391	EEF	AK	Sisters Island
392	ML	LA	Monroe
394	RWO	AK	Kodiak
395	HR	??	Unknown
399	4M	MB	Red Sucker Lake
404	YSL	NB	St. Leonard
530	ADK	AK	Adak Island

For a complete list of ITU Codes, see ***www.word-iq.com/definition/ITU_letter_codes***

❖ Mailbag

Bill Tobin (NM) set out to build the Gyrator VLF receiver referenced a few issues back. He discovered two things when looking at construction options: The Gyrator II receiver is well described online, but FAR circuits no longer carries the circuit board for it. FAR *does* carry the circuit board for the Gyrator III, but neither of us could find the circuit diagram for it online, despite extensive searches.

My advice to Bill was that he consider building the well-documented and proven Gyrator II, and use a simple perfboard approach with point-to-point wiring. It is a simple enough circuit to warrant this construction method. I would appreciate hearing from anyone who might know where to locate circuit information for the Gyrator III, so that we can spread the word here.

Don Rice (UT), an Electrical Engineer at the Space Environment Corporation, had the following comments about Sudden Ionospheric Disturbances: "Kevin, I was reading your *Detecting Sudden Ionospheric Disturbances* column in the March issue of *Monitoring Times*. I've been looking at VLF propagation for some time using some heavy-duty modeling software."

"You mentioned a 'coordinated monitoring activity' on VLF, and you may have heard by now about the Stanford SID project, **http://solar-center.stanford.edu/SID/**, which has data from receivers similar to the one you described. Not all of the data is available in real time, but it is a good resource to check a few days after something happened."

"I've got several monitors running in near-real time (15-minute update interval) available through **www.spacenv.com/~agile/** and I am experimenting with Twitter updates about interesting x-ray events: **www.spacenv.com/~agile/twitter.html**. I'm hoping to add tweets about VLF events (SIDs, station up and down time) soon. It is possible to look up x-ray flares for the last several years through our web page. For example, the flare mentioned in your article can be seen in: **www.spacenv.com/~agile/xray/2009/xray_20091218.png**."

"One last note...the loop antenna used by the standard SID receiver is highly directional, while an 'HD' sound card is capable of catching signals to 48 or 96 kHz (depending on model), so that directionality may not be a good thing if you want to monitor all available VLF signals simultaneously. We use the LF Engineering H-900 active antenna, and feeding its signal directly into a sound card works surprisingly well.

"We got our first LF Engineering antennas through Grove Enterprises...both the H-900 and H-800 work well for VLF and LF, and are omni directional. The catch is that they cost rather more than a homemade loop. Perhaps at some point we can put together an article on why VLF responds to flares the way it does...I certainly have plenty of plots on the subject. Happy listening –*Don*"

Bryan Turner, W8LN (AL) , sent several reports about new amateur assignments on longwave. The first was for Canadian hams. The Radio Amateurs of Canada (RAC) reported that Industry Canada has approved access by Canadian amateurs to the 135.7 to 137.8 "sliver" band with a maximum radiated power of 1-watt on a non-interference basis.

The next news came from New Zealand. The New Zealand Government has agreed to grant its amateurs temporary access to the 505 to 515 kHz band at a maximum radiated power of 25 watts on a non-interference basis. Maximum bandwidth is limited to 200 Hz.

Finally, news came of an allocation for Icelandic hams. This authorization gives hams there temporary access to the 493 to 510 kHz band on a secondary basis, CW only, at a power limit of 100 watts. Licensees will need to apply to the Post and Telecom Administration (PTA) for a special license to operate on this band, and it is open to both "N" and "G" license classes.

See you next month!

ANTENNA TOPICS

BUYING, BUILDING AND UNDERSTANDING ANTENNAS

Mike Frye
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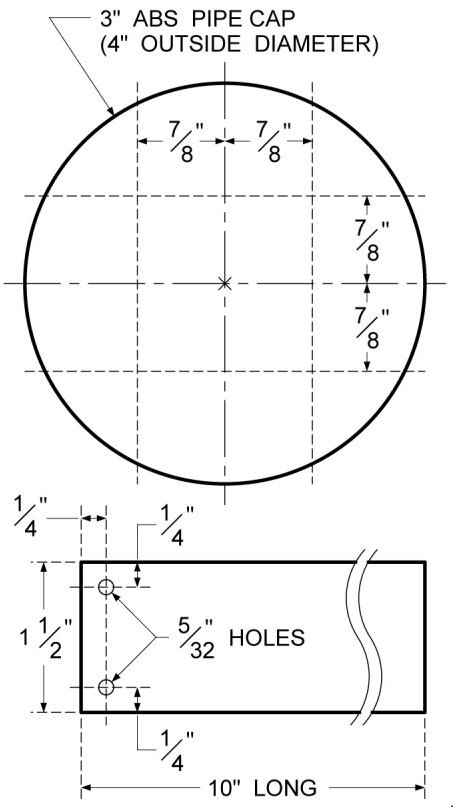
Build this UHF Omni Satcom Antenna: Conclusion

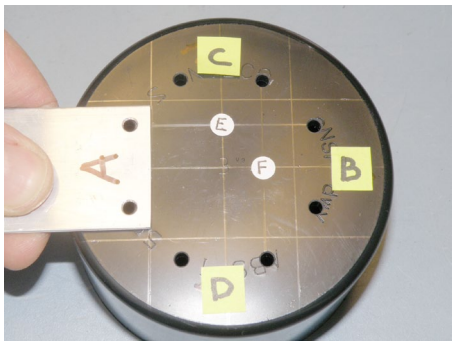
In the March issue I discussed some basic criteria for UHF Satcom reception, developed the ideas that shaped the design of our MT Omni X-wing Antenna, and provided a parts list. This issue will focus on assembly of the Satcom Antenna and options for obtaining best reception.

Let's start construction by cutting four lengths of 1-1/2" wide aluminum flat stock to exactly 10" long, being careful to make the ends square. Mark one end of each element with the hole pattern in Figure 1, then drill to 5/32" diameter. I recommend starting all holes with a 1/16" diameter drill bit and working up to the final size in increments. Also gently deburr each hole with a countersink or larger drill bit.

Instead of drawing a complex pattern on the pipe cap for every hole, we'll draw the simple grid shown in Figure 1 and use the elements as a template. A pencil works nicely for marking on the pipe cap. Label the four elements with A, B, C and D, which will be needed for reference later on.



Place the drilled edge of each element against the edge of the grid of squares and center the element between the parallel lines extending to the edge of the cap as shown in the picture below. Using the element as a template, mark the location of each set of holes with a pencil. Label each set of hole patterns on the pipe cap with an A, B, C and D to match the element that was used as the template.



To mark locations for the F type chassis connectors, orient the pipe cap in front of you as shown in the above picture. Using a straight edge, draw a pencil line from the center of the top hole for element A to the center of the top hole for element B. Where this line intersects with the vertical center line is the location of connector hole E.

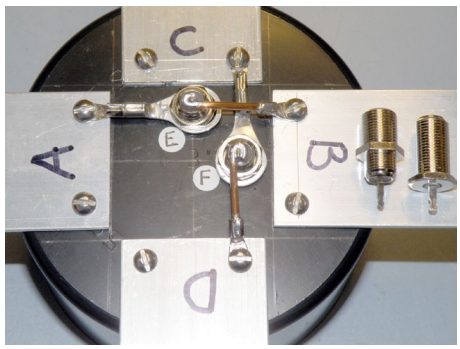
Using the same technique, draw a vertical line from the center of the right most hole for element C down to the right most hole for element D. Where this line intersects with the horizontal center line is the location of connector hole F.

There are two types of chassis mount F connectors that are suitable for this project: the Radio Shack type shown on the left side of element B in the picture below and the longer barrel type shown to its right. For the Radio Shack connectors, drill a 23/64" hole at location E and F, and if using the longer barrel type, drill 3/8" holes.

Temporarily mount the elements using 6-32 hardware placing the screw through the element and pipe cap with nuts on the backside of the cap. There should be enough play in the screw holes so you can line up the opposing elements parallel with each other.

I found the Radio Shack #6 and 3/8" lugs for element ground connections will be at the correct spacing if you remove their plastic insulation and butt them against each other as shown in the next picture. Solder together two sets of these using a short piece of #14 wire between the lugs.

For Radio Shack connectors, gently countersink hole E and F from the inside of the cap to about half the thickness of the cap material.



A 1/2" drill bit works okay for this if you take it slow. Do not countersink for the long barrel connectors!

The Radio Shack connectors will be force threaded, female side first into holes E and F from the top side of the cap. Start threading by hand, then finish with a wrench or deep socket, taking care not to strip the new threads.

For the long barrel connectors place the 3/8" ground lug assemblies over hole E and F then insert the female side of the connector through the lugs and secure the connectors with nuts from inside the cap. For Radio Shack connectors, the lugs will go over the exposed threads on the top of the cap. In either case, the ground lug assembly for connector E will attach to element A and connector F to element D as shown in the above picture.

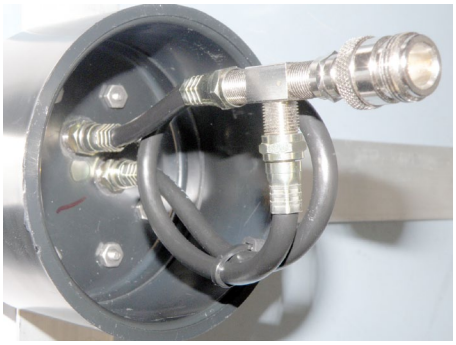
Connect element B and D to the center contacts of connector E and F using a short length of bare #14 wire and #6 lugs as shown in the picture above, taking care not to short the wires to the connector ground. Now is the time to make sure all the hardware is tight on the cap assembly.

To make the phasing harness, you will cut one length of RG-6 cable to exactly 13 1/2" and another length to exactly 3-1/2". Using a sharp knife or razor blade, carefully remove 1/2" of outer insulation from each end of both cables being careful not to cut into the braid or foil.

Next measure 1/4" from both ends of each cable and carefully cut through the braid, foil and foam dielectric without nicking the center conductor. Twist and remove the foil/dielectric lumps from both cables leaving 1/4" of exposed center conductor. Carefully install the F connectors on both cables until the dielectric is absolutely flush with the inside bottom face of the connector.

Assemble the two cables on the Tee connector with the longer cable on the center part of the Tee and the shorter cable and F to N adapter (or SO-239, BNC, etc.) on the opposing connectors.

The picture below shows the phasing harness attached to the chassis connectors inside the pipe cap. The longer cable goes to connector E and the short cable to connector F. If you get this backwards, the antenna will have Left Hand circular polarization and will not work.



The elements will be spaced 20" above the ground screen using an 18" length of 3" diameter ABS pipe. The ground screen can be wire hardware cloth, chicken wire, a car hood, etc. The screen material should be 48" square or round with gaps no larger than about 1" and it can be stapled to a wooden frame, plywood sheet, or simply set on the ground. The lower pipe cap will screw to your wooden frame or a separate piece of flat wood for support.

If there is clearance below your ground screen, you can bring the coax feedline through a hole in the bottom pipe cap as in the picture below, or exit through a hole in the lower side of the ABS support pipe as shown in part 1 of this article. Either way you should consider a drain hole for accumulated water.

Place your new antenna on a flat level surface. Connect antenna to receiver using the shortest practical length of low loss feedline. For feeding long cables there is plenty of room inside the support pipe for a dedicated UHF preamp or a remote TV antenna preamp.

US listeners will want a clear view of the southern sky to the western horizon for West Coast use and East Coast listeners to the eastern horizon. For users just north of the equator, like Hawaii, tilt the south-facing side of the antenna and ground screen upwards to improve reception. Listeners just south of the equator should tilt the north-facing side up. Users in Alaska might also tilt the north-facing side up to improve reception.

I hope you enjoy building and using your new MT Omni X-Wing antenna and snag some rare satcom traffic. Until next time, stay tuned!

RADIO RESTORATIONS

BRINGING OLD RADIOS BACK TO LIFE

Marc Ellis, N9EWJ
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The BC-344 Speaks Again, However. . .

Hello again, readers! I'm back with another installment of the BC-344 restoration. However, this is one of those months when, though the labor was intensive and the results were reasonable, the actual report is going to require relatively few words.

For that reason, I will spend some time to discuss the special approaches usually employed when troubleshooting military equipment. They are a little different from the concerns one has when working on consumer grade radios!

❖ Left Over from Last Month

At the conclusion of last month's session, we were almost ready to power up the BC-344 for the first time. Only a couple of housekeeping items remained to be taken care of. The cathode resistor of the 6R7 second detector/first audio tube was open and needed to be replaced; that was easily done. Also, an audio coupling capacitor – probably formerly one of those "replace-on-sight" Micamold capacitors (the ones that look like large micas, but aren't) had been replaced. But the replacement was one of those equally unreliable Sprague "Black Beauties" – recognizable by its shiny black plastic case.

That, too, was easy to take care of and I was just about ready to apply power. But – oops – how to plug it in? The back of the RA-20 rectifier (the radio's power supply) was equipped with what looked like the business end of a standard male a.c. plug set in the bottom of a cylindrical well. I was going to need a socket that would fit inside the well and engage those blades.

Luckily, my junk box yielded a female extension cord-end in a soft rubbery housing. It fit snugly with very little persuasion, so, after installing it on the end of a spare line cord, I was in business.

❖ Good News and Bad News

I didn't feel the need to start up the radio on a Variac, since I had already replaced all of the capacitors likely to fail except for the filter capacitors in the power supply. And I had given those the benefit of a slow start-up in the previous work session. So, after connecting a voltmeter to monitor the B plus line, I just plugged in the set, jacked in my new LS3-speaker (the correct military speaker for this radio – see last month's column), turned the power switch to the AVC (automatic volume control) position, and crossed

This "Black Beauty," which was replaced on sight, had been installed as a replacement by a previous restorer.

my fingers.

The B plus rose to perhaps 350 volts and settled down to the expected 250 or so as the tubes warmed up. I was shortly rewarded by the hiss of atmospheric and electronic noise, and soon I was tuning in a number of broadcast stations on a short basement antenna.

The two highest frequency ranges of the BC-344 – 450-820 kHz and 820-1500 kHz – cover most of the broadcast band. I was unable to hear much on the lower two ranges – 150-260 kHz and 260-450 kHz – but didn't expect to with just a few feet of antenna on the basement floor.

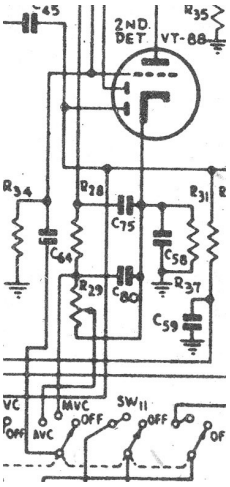
I thought I was now home free with the electronic restoration and ready to begin realignment and some cosmetic clean-up – that is, until I switched over to MVC (manual volume control). In this mode I was able to hear no sound until the volume control was almost all the way up. Then the sound came in with a burst, but was highly distorted. Soon after that, the radio quit altogether, and, noticing that the B plus had dropped to about 70 volts, I quickly pulled the plug.

❖ Operator Trouble?

Troubleshooting the power supply short circuit turned out to be aggravating because the short was intermittent. I disconnected the B plus lead from the power supply, pulled all the tubes, and did a quick resistance check at their plate pins – a technique that had enabled me to pin-point the location of the short circuit I dealt with last month. But all values were within the proper parameters. Checking the resistance to ground of the B plus lead from the supply and the B plus terminal of the radio, I found no sign of the short.

Accordingly, I powered up the set again – but quickly turned it off when I realized that the B plus voltage was, once again, not going to make it over 70. The short was back! I'll spare you my further adventures in troubleshooting the short as it came and went a few more times.

Cutting to the chase, the mysterious short turned out to be caused by a stray, almost invisible, wire strand that had separated from the end of the power supply B plus lead. This strand was contacting the power supply chassis whenever the lead was connected to the set and the power supply was swung into normal position for radio operation. But when the lead was disconnected from its terminal, as was required for the resistance checks, the strand was no longer in position to cause a short.



C64, the leaky capacitor (see text), is shown at left, center.

Readers will remember a similar mysterious short that took up some troubleshooting time last month. Again it was an almost invisible connection between a B plus lead (on the second r.f. can) and chassis ground. I didn't find it until I had to repeat the annoying exercise of dropping the second r.f. can out of the receiver. But I was relieved to discover, at least, that I wouldn't have to open the can up, not having caused any shorts when replacing the capacitors inside.

I guess you could say that I have only myself to blame for these problems. But if you ever take on the job of restoring a BC-314/BC-344 or a BC-312/BC-342, keep in mind that these are very compactly-built, tightly-organized radios. Clearances between terminals and between terminals and the chassis are frequently quite small. When removing and replacing components, it's not always easy to match the original tight wrap of leads on solder lugs. But sometimes you have to come close or suffer the consequences!

❖ Troubleshooting Military Equipment

The mysterious appearing and disappearing short circuit, as you've no doubt already concluded, was not related to the poor audio performance in the radio's MVC position. And I have to admit up front that, though I've definitely made some progress, I have not yet solved this problem. As I learned during the BC-348 restoration I carried out several months ago, and am now learning anew, troubleshooting in

a tightly-built military radio in which all of the small components are mounted side-by side, in groups, on terminal boards, is a little different from working with consumer sets.

With military gear one can study the schematic, decide that a certain component is suspect, and then not be able to find it in the radio, even though all or most of the components are labeled with their schematic designations. There's a perverse principle that the component you are looking for is likely to be located on a terminal board you didn't even know existed, tucked away in some hidden corner of the chassis.

Or, if you are lucky enough to locate the suspect component, you might find that it is practically inaccessible. You might have to half tear apart an area of the chassis to get at it – something that you would hate to do based on mere speculation.

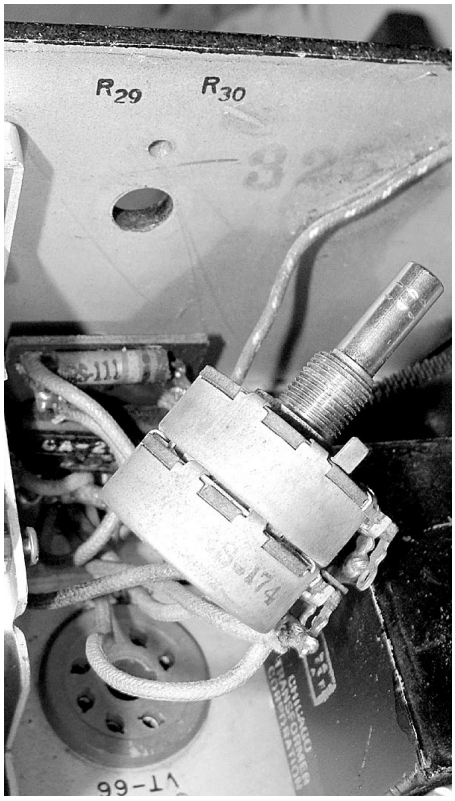
That's why, when working on military sets, you will find yourself relying heavily on prepackaged diagnostic information in the manual for the equipment. The information will be in the form of voltage and/or resistance readings to be expected at various circuit points. If a value turns out to be not as expected, the manual may make a suggestion about the cause – or it may not. But the very fact that there is an odd reading at a point will alert you to examine that part of the circuit with some assurance that the trouble will be found there.

You'll still need help in finding the suspect component, and that's where a good manual will be of great help. It will have profuse illustrations of all parts of the chassis with callouts showing component and terminal board designations. And, separately, it will show details of the circuit boards, pointing out the location of every component on the board.

The manual I'm using for this restoration is the TM-11-850, which is a field service manual for the BC312/BC-342 and the BC-314/BC-344. It contains good descriptions of the circuitry, shows all of the necessary voltage and resistance values, identifies all of the major components and provides complete realignment identification. What it doesn't do very well is the identification of the individual components on the various terminal boards.

That isn't a problem if you can find the right terminal board, because, as mentioned, all of the components on it will be labeled. If you can't find the board because it is tucked away in a location where you never imagined it would be, then you need a more comprehensive manual. That would be the TM-11-4001 for the BC-312/BC-342 and the TM-11-4002 for the BC-314BC-344. These depot level manuals are amazingly comprehensive.

I have a copy of the TM-11-4001 but not the 4002. However, the 4001 is very helpful in my BC-344 project because, though part numbers are different between the two sets of radios, parts with the same function are in analogous physical positions. For instance, if I need to find the location of a certain bypass capacitor in the BC-344, I can look up the part number of that same capacitor in the BC-312/342 then find out the location of the terminal board where it is mounted. Chances are my BC-344 part will be in the same location.



The tiny circuit board holding the leaky capacitor was hidden beneath the volume control.

❖ The MVC Audio Problem

My first approach was to use the schematic alone to scope out the components whose failure might cause more trouble in the MVC mode than in the AVC mode. I picked out a few, found them to be virtually inaccessible, and – as discussed in the previous section – was reluctant to tear other circuitry apart to get at them. Next, I looked in my TM-11-850 for circuit points for which test data was given and which might be associated with the problem I was experiencing. The volume control terminals and the MVC-AVC switch terminals looked like good bets.

The resistance readings at all six volume control terminals matched up with the expected values in the manual, so I moved on to the MVC-AVC switch terminals. One of them did show an anomaly. To locate it, see the schematic section I'm including with this article. It shows some of the circuitry associated with the second detector tube. The switch terminal in question is connected to the bottom of capacitor C64 (at left center). The reading to be expected between that point and ground is infinity (in other words, an open circuit).

The reading actually obtained was in the vicinity of 300,000 ohms. At first one might think "well, that's pretty high – it's practically an open circuit." But look again. The only way there could be any resistance reading at all at that point would be if audio coupling capacitor C64 were leaky. And so that capacitor had to be changed out, whether or not it might correct the particular problem we're dealing with.

The next problem was finding C64! I looked everywhere I could think of, but could not find a C64 listed on any of the terminal boards. The lead connected to that switch terminal took a dive through a hole going through to the other side of the chassis, but where it came out wasn't particularly obvious!

It was time to use the TM-11-4001 see where the analogous BC-312/BC-342 component was stashed. And that turned out to be on a tiny terminal board under the volume control. Also on the board were a couple of resistors – one of which was analogous to R34 on our schematic.

Sure enough, pushing aside the wiring to the volume control on our BC-344, I could see a similar terminal board. An ohmmeter check verified that there was continuity between the capacitor on that board and the MVC-AVC switch terminal in question.

But locating the capacitor is only part of the problem. Even with the volume control dismounted and moved aside and the adjoining CW oscillator shield cover removed, the little terminal strip is virtually inaccessible. Perhaps I will be able to reach the capacitor with a side cutter and disconnect one end, removing it from the circuit while leaving it in place. Then I can connect my replacement to an equivalent, but physically more accessible, circuit point – just as I did in several cases when recapping the r.f. circuit cans.

❖ Next Month

We'll try doing something like that next month. We'll also check inside the i.f. cans to make sure there are no questionable caps within. If that doesn't clear up the problem, we'll check out the resistance readings given for all of the receiver terminal boards to see if we can spot any anomalies.

As you know, readings are also available for all of the tube base pin connections (not just the plate pins checked this month). But those were already been checked a couple of sessions back when we were looking for power supply shorts and all readings were normal.

Assuming that we do clear up the audio problem, the next steps will be touching up the receiver alignment and taking care of some cosmetics. The front panel actually has quite a nice finish, needing only a going-over with a damp cloth to remove dust. After that's done and the knobs are removed and soaked in a detergent solution to get rid of some greasy dirt, the restored receiver should look quite sharp!

"Sky-Wires & Inhalers"

Part 9: "Proof of the Pudding" for the Low-Pass Filter

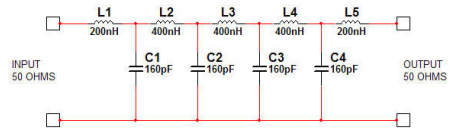
By Walter Lindenbach

(Note from Walt's Wife: "If you have any questions about building or using this filter, do feel free to send him a note and ask. He hasn't enough to do, and is being a nuisance. I'll make sure he answers you. His e-mail address is at the end of the article.)

Last time, Chuck came to Bill's place with a bag of parts to make a low-pass filter. They had decided that Chuck needed one to eliminate FM and TV signals from the shortwave band. They discussed how to assemble the parts, and looked at Walt's filter to see how he had assembled one.

Chuck left, saying that he had the idea, and that he would assemble it at home. Now, it remained only to test it.

Just to remind you of what they're talking about, here is the schematic diagram, and a picture of the filter that Walt assembled.



"My, you look like the cat that swallowed the canary!" was Bill's first comment. "Does that mean that you put the filter together?"

"Sure it does! It's all set to be tested."

"Good stuff, young feller. Let's have a look."

So Chuck took out his assembled filter and Bill reached for the ohmmeter.

"First thing to do is to check for continuity between the center pins of the input and output BNC connectors. There should be almost no resistance because the coils are all in series between these points. Yup, looks good.

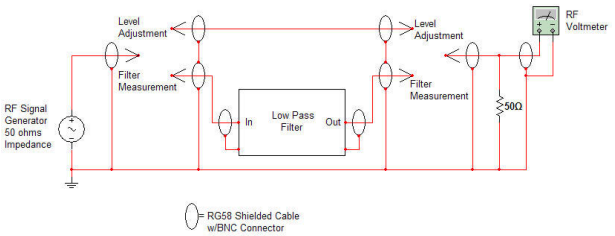
"Now we'll check the resistance between the center pin and the outer shell of the input connector. It should be wide open, because only the capacitors connect between the center pin and the outer shell."

Bill looked up from the ohmmeter and nodded.

Chuck saw that the ohmmeter had indicated an open circuit and asked, "So, what's next?"

❖ "Proof" is RF Testing

"Now," replied Bill, "we connect up a signal generator and an RF voltmeter to see if the filter is doing what it's supposed to." He took a paper and drew a diagram. It is Figure 3.



"This is how to connect the filter for RF testing.

"All the connections in this diagram are made with RG 58 co-ax shielded cable with BNC-M – that means male BNC connectors – on the ends.

"And there are Tee-adaptors with one BNC-F and two BNC-M connectors. If you place one at the RF generator and one at the RF voltmeter, the generator level can be measured by placing a BNC-M to BNC-M cable jumper between them.

"Then, to measure the filter response, the direct jumper can be removed, and the jumpers to the filter connected instead.

"The 50-ohm termination is made with a coaxial resistor which has a BNC-F connector. It must be in place for generator level adjustment, and for filter response measurement."

"I'll bet you have all these doodads."

"Yes. They're over here on the workbench," was Bill's reply. "Let's go."

So, with the equipment connected as shown in Figure 3, Bill first set the generator for 1 MHz and adjusted the level for 0 dBm.

"Why those settings?" Chuck wanted to know.

"Because 1 MHz is well within the passband of the filter, and the attenuation should be just about 0 dB, so all other measurements are made relative to this one.

"And, unless you can trust the RF generator to maintain 0 dBm as you change frequency up to 50 MHz, the 'level adjustment' connection has to be made before every new frequency measurement.

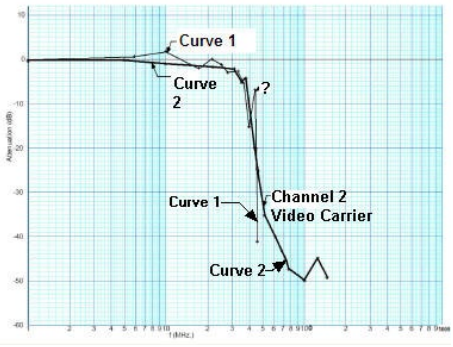
"The level setting of 0 dBm is handy for calculating the filter loss at different frequencies, and RF generators may provide as much as + 10 dBm at some frequencies but not at others."

❖ "Proof" is a Graph

The measurements looked like Curve 1 below.

"Looks pretty good, huh?" said Chuck, "But what's that 'spur' – here?" – and he marked an arrow and a '?' on the graph.

"That's probably because one or more of the coils is a bit too small. They should have a bit more inductance. But don't worry about it; notice where the Channel 2 – that's the lowest video carrier – is? It's more than 40 dB down from our reference level, 1 MHz. "



❖ Spurs? Squeezing?

"Yeah but" – this from Chuck, with a pained look on his face, "do we have to leave that 'spur' sticking out?"

"Uh huh, I figured you wouldn't be content," replied Bill with a smirk on his face. "No, we don't have to leave it there. If we squeeze the turns of wire of the coils together, the inductance will increase. That's better than pulling apart your very neat assembly."

Chuck took the cover off of the filter case, and pressed the turns of the coils together as much as he could, put the case back together, and they made more measurements which are shown as Curve 2 in Figure 4.

"Oh, that's much nicer," Chuck observed.

"Yes, but look where the Channel 2 carrier is. It's only about 33 dB down."

"Is that bad?"

"No, no, for your purposes, that's lots," Bill reassured him.

"Okay, good. Now, how do I connect it?"

"Well, you're still using your little 12-foot random wire antenna, aren't you?"

"Sure. What else? Which reminds me. Didn't you mention a loop antenna once upon a time?"

"Yes, but let's get your filter connected first. You're using the transformer that we made a while ago between the antenna and the receiver, yes?"

"Yes, I am."

"That's good, because this filter is made to work with a 50-ohm source and 50-ohm load. Connecting it directly between your antenna and the receiver would work, but not nearly so well.

❖ Where the filter fixes QRM

"So, all you have to do is connect the transformer output to the filter input with a length of RG 58 cable that has BNC male connectors on the ends, and then, with another length of BNC cable, connect the filter output to the receiver."

"And then what will happen?"

"It's not what will happen, it's what will *not* happen," replied Bill. "The sync buzz from the TV stations and the distorted FM station programs that you have been hearing will be gone. And, some signals that were the result of 'inter-mod' will also be gone."

❖ More QRM?

"Talking about extra signals, it seems to me that last time you mentioned an AM radio station that was putting a whole bunch of extra signals into the lower part of your shortwave band. Maybe we should do something about that."

"Oh yes, please," replied Chuck enthusiastically. "Is there another filter that will get that stuff out?"

❖ A High-Pass Filter

"There is. It's called a High-Pass Filter, and it can reduce the signal level from AM broadcast radio stations enough to prevent something called 'intermod'.

"That term stands for 'intermodulation', and refers to what happens in your receiver when a strong signal causes the RF stages to operate nonlinearly. That means, for one thing, that a stage is overloaded and the signal will be distorted.

"That's bad enough, but it also means that the strong signal will mix with other signals and produce 'intermodulation products' which are the sum and difference of the two signals that are mixing. What's the frequency of the new AM radio station that's troubling you?"

"1240 kHz, "replied Chuck.

"Yes. So let's say you're trying to listen to a station at 3 MHz. If the AM radio station at 1240 kHz is causing nonlinearity in your receiver's RF stages, you will hear it at 1760 kHz – that's the difference between the two frequencies – and at 4240 kHz. That's the sum of the two frequencies. Sound familiar?"

"Oh my, does it ever! So the High-Pass Filter will reduce signals from the broadcast band so that they will not cause the receiver RF stages to distort and produce intermodulation. Is that right?"

"You got it," replied Bill, "wanna build one? It's not quite as easy as the Low-Pass Filter."

"That's all right," Chuck exulted, "I'd love to. But – "

"I know. Time's up. We'll start next time."

"Wonderful! G'nite."

"G'nite."

Walter Lindenbach can be reached at lindenbachw@shaw.ca.

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Digital Digest continued from page 27

That's all for this month and have fun with your first digital signal.

Typical Message from Halifax

NAWS DE CFH ZKR F1 2822 3394 4167 6260 8324 12371 16552 AR

Typical Message from Pinneberg

ZCZC 411
SMVX42 EDZW 301800 RRC
BBXX
MINUK01 3018/ 99602 70012 46/// ///// 10045 40009 57007=
NNNN
ZCZC 421
FQMM79 EDZW 301800
WEATHER AND SEA BULLETIN FOR EASTERN MEDITERRANEAN SEA ISSUED BY MARINE WEATHER SERVICE HAMBURG
30.03.2010 18 UTC:
GENERAL SYNOPTIC SITUATION:
HIGH 1020 NORTHEGYPT TO AEGEAN SEA, SLOWLY MOVING EAST.
FLAT LOW 1009057,8'8-, MOVING EAST. LARGE GALE CENTRE 983
NNNN

RESOURCES

TrueTTY - **www.dxsoft.com/en/products/truetty**
MultiMode - **www.blackcatsystems.com/download/multimode.html**
CocoaModem - **homepage.mac.com/chen/w7ay/cocoaModem/index.html**
Fldigi - **www.w1hkj.com/Fldigi.html**
iMic - **www.griffintechnology.com/products/imic**

GLOBALNET

Exploring the World of Internet Radio and Television

Loyd Van Horn, W4LVH
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Earthshaking Radio

Tuning in earthquakes, hurricanes and more

When I was growing up, natural disasters weren't just a few minutes of footage at the beginning of a newscast in my home. At the first mention of a hurricane or earthquake, the power to dozens of radios in our family radio room would be turned on and tuned in to the action.

When the ground shook or the wind and rain blew, this usually meant usually tuning in to shortwave radio stations or HF broadcasts from amateur radio operators right in the heart of the destruction.

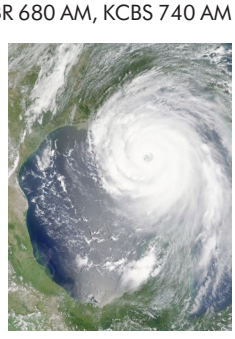
While there is still plenty to hear during disasters on HF, there is a new venue for listening to the latest news and information at ground zero: Internet radio.

During the massive Haiti earthquake earlier this year, my first instinct was to break out my Internet radios and tune my Web browser to the streams of stations in the country. While many were off the air, a few did manage to stay on and and were running breaking news from the heart of the country. One station was taking calls from local residents. Many of the broadcasts were in French, but to know that the audio I was listening to was coming from the location of such destruction was fascinating.

Fast forward to the huge earthquake that struck Northern Mexico in April. I immediately tuned my Internet radio to KNX-1070 in Los Angeles. There was non-stop coverage of the quake including live press conferences, calls from residents reporting damage, and live audio from the aftershocks. If another 'big one' had hit, I would have had a front row seat. While the big cable news stations were discussing politics or the economy, I was still getting late-breaking news from the heart of earthquake country.

For future earthquake activity in California, the following stations (among others) should provide on-the-spot information:

Los Angeles
KNX 1070AM, KFI 640 AM, KABC 790 AM
San Francisco
KSFO 560 AM, KNBR 680 AM, KCBS 740 AM



Now we find ourselves headed into what experts are saying will be an above-average year for Atlantic hurricanes. Should a big storm develop, I will be able to turn my Internet radio and computer into a 24-hour information source direct from the scene of the action.

Here are a few stations to keep in mind should hurricane season get messy in the Atlantic. Keep in mind that many of the Caribbean stations are in their native language:

United States
Mobile, AL – WNTM 710 AM
Jacksonville, FL – WOKV 690 AM
Savannah, GA - WBMQ 630 AM
Miami, FL – WFTL 850 AM
New Orleans, LA – WWL 870 AM
Wilmington, NC – WFNC 640 AM
Charleston, SC - WTMA 1250 AM
Houston, TX – KTRH 740 AM

Caribbean
Aruba – Real FM 90.7, Radio Kelkboom 106.7
Bahamas – More 94FM, Cool 96FM
Barbados – CBC Radio 94.7
Cuba – Radio Reloj 760 (among several others in the network) Radio Rebelde 550 (among others in the network)
Haiti – Radio Delta Stereo 101.9, Radio Tele Ginen 92.9, Radio Vision 2000 99.3
Jamaica – Nationwide Radio 550AM, NewsTalk 93FM
Montserrat – ZJB Radio 91.9
Trinidad and Tobago – Talk City 91.1FM, Socca FM 91.9,
Turks and Caicos – RTC Radio Turks and Caicos 101.9, TRB 105.5
Virgin Island (U.S.) - 103.5 WAXJ, 970 WSTX

For the stations in the United States, searching on Reciva by location will also often pop up streams for local police and fire streams as well as NOAA Weather Radio broadcasts. These can be additional fascinating sources of information when storms hit.

In addition to the obvious solution of tuning in stations from the affected areas, there are also a large number of online receivers you can use to tune in everything from local AM radio stations to HF/VHF and UHF transmissions from around the globe. These too can provide you with an on-the-spot ear to events as they unfold.

While many of us who grew up frantically tuning the dials during such events might find it a bit awkward at first to turn to a computer or WiFi radio for such information, the results can indeed be rewarding and helpful when disaster strikes.

❖ Administration enters 'pay-for-play' debate

As if there weren't enough weight being thrown into the discussion over whether radio stations in the U.S. should be forced to pay royalty fees to individual artists for playing their songs, another 'big name' has added its opinion to the mix.

The general counsel of the administration's Commerce Department has voiced support for the artists, saying radio stations should be forced to pay royalties to them for playing the music on their stations. In a recent release, Cameron Kerry said the proposed bill, which forces the royalty payments, would "level the playing field" among broadcasters.

If enacted, the bill would advance public welfare by compensating American performers and the record companies that produce and distribute their creative works, said Kerry.

The National Association of Broadcasters quickly announced their displeasure with the Obama administration's support of the bill, saying the measure would eliminate jobs in the U.S. and send money to foreign record labels.

The fight has been heating up since the beginning of the year, after subcommittees in both houses of Congress have approved similar measures, building support for the proposed forthcoming legislation. Voices on both sides of the issue have been campaigning vigorously for their side.

Supporting the artists, big names like Bono, Sheryl Crow and others have spoken on Capitol Hill, saying the additional fees are the only fair compensation to artists. Meanwhile radio proponents have argued the additional fees (radio stations already pay royalties to song publishing companies and the actual writers of the song, not to individual performers) would stretch already thin budgets to the breaking point.

❖ iPhone's OS 4.0 can multi-task!

iPhone and iTouch users, rejoice! Your device will now support true multi-tasking. For Internet radio fans, this is a much-awaited improvement!

Finally, you can stream your favorite Internet radio station through one application, while checking your email or updating your Facebook account through another.

There is already an app in the App Store that claims to be able to run streams in the background. The popular 5-0 Radio application (Recently on sale for $1.99, but usually running 4.99) supports 'background mode.'

In testing my iPhone 3GS, I tried running a stream called "Chicago Police" in background mode. What it tried to do was open a Quick-

time file in Safari for the stream, but I kept getting an error message that the movie type was not supported. I changed to a stream for the New Orleans Police department, and this time, the stream indeed loaded and I was able to run it in the background while I checked my email, sent a few text messages and more! To stop the stream, I just opened Safari and closed the window with the stream playing.

Technically, this is not true in-application multi-tasking, since it requires opening up a second stream through Quicktime, but, the new operating system will fix that.

From all indications, the new multi-tasking for iPhone 4.0 seems to be a gem. Already, Pandora has jumped on board with the upgrade and supports multi-tasking in its application. It even allows you to use the iPod controls when double-clicking the 'home' button while the device is in locked mode.

Along with multi-tasking, the new operating system has a plethora of additional features such as an organization system for applications, implementation of iPad's iBooks, and more. The public release is slated for sometime this summer as of press-time.

Users of 2nd generation iPhone or iTouch will have to upgrade their devices to newer ones to use the updated software. That means those running iPhone 3G will have to upgrade to the new device slated for release this summer to coincide with the new operating system. Those running iPhone 3GS should be fine.

❖ Bad news for 'free' Internet radio?

A recent ruling by the U.S. Court of Appeals could spell trouble for services like Pandora, Internet radio streams and other high bandwidth services. The ruling effectively stated the FCC has no power to tell Internet Service Providers that they have to keep their hands off the traffic coming through their networks.

At the heart of the issue was a decision by ISP Comcast to block BitTorrent, a popular file sharing service, because of the strain the data sharing was causing on its network. The FCC then stepped in claiming this was an unfair singling out of one service, and that in the name of Net Neutrality, Comcast needed to allow its users free reign to use bandwidth-intensive services.

The Court of Appeals ruling says that the FCC had no right to mandate that an ISP cannot regulate this type of traffic.

There is concern among some that this ruling now opens the doors for ISPs, including wireless providers, to start charging additional fees for those using high-bandwidth services such as Pandora and Internet radio streams.

This has enormous implications for those of us who enjoy streaming Internet radio. Could we soon be forking out additional premiums for using these services, or being denied service altogether because of our taste for streaming content?

The writing is certainly on the wall, but it may be too early to tell what it means...

❖ GlobalNet Mailbag

The letters and emails keep pouring in! Over the past few months the response has really taken off, and it is thrilling to see the positive response the column is getting. This month's mailbag contribution comes to us from Tom in Nova Scotia:

Hi Lloyd.

I enjoyed your article on the Logitech Squeezebox radio. I will be asking Santa for an Internet Radio, (perhaps an early Xmas). I had been looking at a Sangean or a Sanyo; but now I must think about the Squeezebox. One of my hobbies is listening to TransAtlantic flights on HF, and using AirNav to actually find them. Do you think that any of these HF freqs will ever be on internet radio?

Tom, VE1TJE, Halifax, Nova Scotia

Tom, thanks for the email! You might look into the growing hobby of tuning in online receivers to tune in HF transmissions. As mentioned briefly above, there are a number of online receivers that are streaming HF/VHF and more from around the world! These are actual receivers that DXers have set up so that listeners like you or I can actually tune the dials of their radios to hear what they can hear from their location!

As a nearly life-long Mediumwave DXer, I have really enjoyed using these services to tune in Mediumwave frequencies from the Middle East, Europe and other parts of the world! It has all of the snap, crackle and pop of a traditional DXing session, but the results can be far more exotic than what most of us are used to from our own listening posts.

Mind you, these streams probably won't be accessible through Internet radios like the Squeezebox due to the interfaces required to operate the radios, so you will have to use your computer to operate them. I have had great success with the **Global Tuners** website, but you can find a few other websites in the *GlobalNet* links table at the end of this column for links to hundreds of online receivers that span the globe.

Maybe one of our more tech-savvy and entrepreneurial-minded readers could develop an Internet radio DX receiver that tunes in some of these streams, but resembles a traditional shortwave radio and allows you to change frequencies directly from the device. Now *that* would be the best of both worlds!

Hopefully this will not only help with your question, but open new doors for listening opportunities for you and the rest of the *GlobalNet* readers!

Till next month, 73s and good listening!

GLOBALNET LINKS

Reciva: **www.reciva.com**
Scanner App to run in background: **www.mobile-ent.biz/news/36680/Police-Scanner-iPad-app-claims-to-run-in-the-background**
Pandora jumps on board multi-tasking upgrade: **http://news.handheldtems.com/iphone-4-0-os-update-more-info-on-multi-tasking/**
New iPhone operating system to implement multi-tasking: **www.foxnews.com/scitech/2010/04/08/apple-releases-iphone-os/?test=latestnews**
Online Receivers at DXZone: **www.dxzone.com/catalog/Internet_and_Radio/Online_Receivers/**
Online Receivers.net: **http://onlinereceivers.net/home.php**
OE3MZC's Online Receivers List: **www.qsl.net/oe3mzc/receivers.html**
Online Receivers Wiki Article at Radio Reference: **http://wiki.radioreference.com/index.php/Live_Tunable_Receivers**
GlobalTuners: **www.globaltuners.com/**
Obama Administration Backs Arists - **http://abcnews.go.com/Entertainment/wireStory?id=10264047**
Pandora's "free" reign coming to an end? - **http://satwaves.com/blog/2010/04/08/u-s-courts-signal-the-death-knell-of-pandora-a-win-for-sirius-xm/**

MT REVIEW

FLEX-3000™ SDR Transceiver Review, Part 2

The future of radio in your shack today

By Larry Van Horn, N5FPW
Monitoring Times Review Editor

In the May issue of *Monitoring Times* I presented part one of my review of the FLEX-3000™ SDR by FlexRadio Systems™ in Austin, Texas. In part two of our *MT* review, I will discuss the set-up and operational aspects of the FLEX-3000 transceiver.

❖ What's in the Box?

The following items are included with each FLEX-3000 unit that ships from FlexSystems: FLEX-3000 transceiver; 6-pin to 6-pin FireWire® cable (6 feet); Unterminated 12 AWG power cable (4 feet); PL259/BNC adapter; Quick Start Guide; and a CD ROM with the owner's manual, quick start guide, PowerSDR™ 1.18 or later, FlexRadio FireWire Driver.

When you order your FLEX-3000, if you plan on using it with a laptop, you will probably want to have FlexSystems ship a 6-pin to 4-pin FireWire cable instead of the normal 6-pin to 6-pin.

The FLEX-3000 power cable is unterminated at one end so that you can adapt it to various DC power connectors, such as Anderson Power Poles, banana plugs, screw terminals or spade lugs. You will be connecting the two red wires to the positive terminal and the two black wires to the negative terminal of your power supply.

❖ Setting Up the FLEX-3000

After you unpack the materials from the shipping carton, you should first determine where in the shack you are going to set up the FLEX-3000. Some basic considerations here include: place it near the computer you will use, avoid placing it in direct sunlight; avoid blocking cooling vents for good air flow and temperature control; easy access to the back panel of the 3000, and other considerations such as antenna connections, power supply location and operating needs.

You will need the following to get your FLEX-3000 on the air:

- The two cables and CD-ROM that came with your FLEX-3000.
- An HF-Antenna or dummy load.
- A good RF ground.
- A stabilized 13.8V DC power supply, capable of 25A continuous duty.
- A Windows® PC, with an IEEE 1394 (Firewire) connection.
- A microphone/PTT and/or CW paddles/keyer/straight key.

Prior to powering up any radio, I prefer to connect all my peripherals first to reduce the chance of a static discharge that can take out some valuable electronics. So things like grounding wires, microphone, key, speaker/headphone, antennas, power cables to the power supply, and the FireWire cable are all connected prior to turning on the power supply and the transceiver.

Also prior to powering up the transceiver, you will be installing your FireWire device driver. After that installation you will be restarting the computer and turning on your 3000 transceiver.

After you have successfully installed your device driver, you are then ready to install the PowerSDR software. Follow the directions carefully, but before you get started, you need to ensure that the current version of Microsoft .NET Framework 1.1 and .NET 1.1 Service Pack 1 is installed on your computer.

You can get more information on this at the following knowledge base links on the FlexSystems website: **http://kc.flex-radio.com/KnowledgebaseArticle50072.aspx** and **http://kc.flex-radio.com/KnowledgebaseArticle50073.aspx** This is an important step as you won't be able to run the PowerSDR software unless you have the right .NET Framework software package installed.

In the final steps, you will be configuring your device driver (previously loaded), setting up audio parameters, and configuring your Windows audio mixer panel. There are detailed instructions on all of this in Chapter 2 of the FLEX-3000 owners manual.

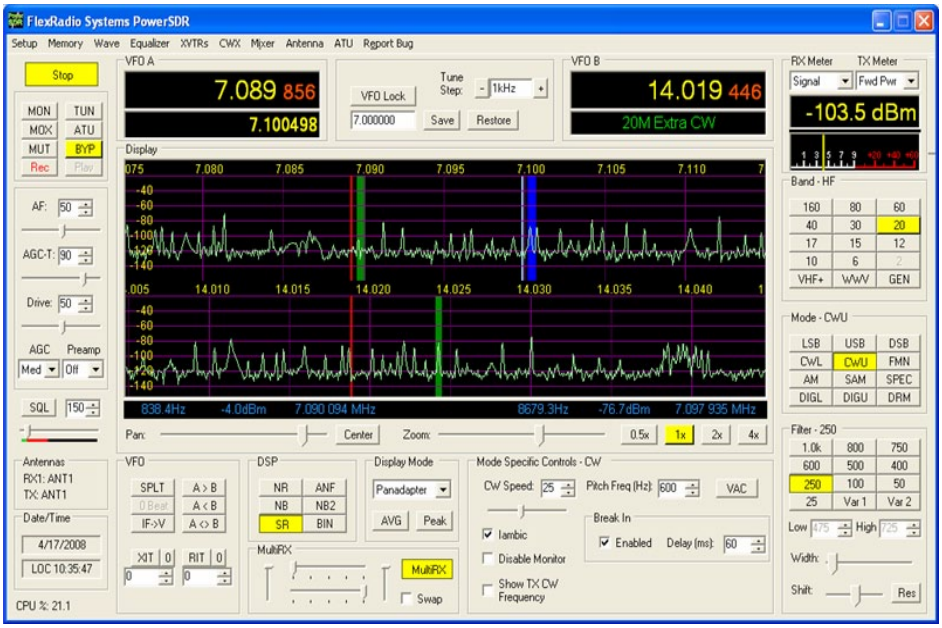
If you have successfully accomplished all of this, you will be ready to hit the Start button on your PowerSDR software and commence operations.

❖ Powering up the FLEX-3000

If you have powered up the radio and software, at this point your eyes will probably be as wide open as mine were. Look at figure one and you will see why. For some, all the bells and whistles you see on the PowerSDR front console may be a bit overwhelming.

The front console (see Figure 1) controls the basic functions of the radio: frequency, mode, filters, and display. To help you get use to the controls and their functions I recommend that you hover your mouse over any control, and it will present a tool tip that will show a brief description of that control's function.

I know it will be tempting to load up and key up without further instruction or guidance, but I highly recommend you don't. There is a lot of capability on your computer screen in front of you right now, and if you really want to take advantage of that I recommend that you point your browser to this link (**www.flex-radio.com/Products.aspx?topic=powersdr1x_testdrive**) on the company website.



Final Rating: 4-3/4 out of 5

I won't go into detail on the operation of the FLEX-3000 using the PowerSDR software, since that would be outside the scope of this review. The Adobe PDF owner's manual is extremely well written and illustrated, and has detailed explanations of all the controls and menus that are available on the PowerSDR front console. No matter what level of technical expertise you have, the owner's manual can provide you with simplified or detailed information on the operations and controls of this transceiver.

As I have mentioned previously, this is a highly capable transceiver. As an operator you have nearly complete control over every aspect of transmit and receive operations with this unit. To truly appreciate this fact, browse through the various tabs and menus in the setup and operating forms within the PowerSDR software package. You really need to become familiar with these menu options prior to transmitting with the FLEX-3000.

For instance, some of the options you can control using the software operating forms include: memory channels, recording and playback of post-processed audio, a three and ten-band equalizer, Transverter setup form, CW memory and keyboard control, an audio mixer control, and voltage/temperature information. I repeat: You have a lot of capability with this radio/software control package.

TABLE 1: FLEX-3000 MANUFACTURER SPECIFICATIONS

Receiver Frequency Range:	10 kHz – 60 MHz (operating – requires external, customer provided filters below 1.8 MHz to eliminate images); 160m – 6m (specified amateur bands only)
Transmitter Frequency Range:	160m – 6m (specified amateur bands only) and MARS/CAP capable
Emission Modes:	A1A (CW), A3E (AM), J3E (LSB, USB), F3E (FM), F1B (RTTY), F1D (PACKET), F2D (PACKET)
Frequency Steps:	1 Hz minimum
Antenna Impedance:	50 Ohms, unbalanced; 17 - 150 Ohms, unbalanced (with tuner on); and Max SWR 3.0:1 (with tuner on).
Audio In/Out:	10dBV nominal (consumer level), input impedance: 5k Ohms/Output impedance 600 Ohms.
Recommended Headphones:	40mW, 16 Ohms, (higher impedance headphones will also work)
Power Consumption:	1.5A receive (typical) and 25A (transmit maximum @ 100 watts)
Supply Voltage:	13.8 VDC ± 10%
Dimensions: (WxHxD):	12.3" x 1.8" x 12.3" (31.1cm x 4.4cm x 31.1cm)
Receiver Circuit Type:	Direct conversion, low IF
Intermediate Frequency:	Software selectable from DC to 20 kHz
MDS:	14 MHZ Receive gain – 1.3/0.3 μV; MDS: -123 dBm/-133 dBm in 500 Hz bandwidth
Selectivity (–6/–60 dB):	CW: 500 Hz –6/-60 dB: 5.00/6.40
	SSB: 2.4 kHz –6/-60 dB: 2.39/2.54
	AM: 6.6 kHz –6/-60 dB: 6.60/6.74
Image Rejection:	70 dB or better (160 - 6m amateur bands)
Transmitter	
Power Output:	1-100 watts PEP CW and SSB (25 watts AM carrier)
Emission Modes:	A1A (CWU, CWL), J3E (USB, LSB), A3E (AM), F3E (FM), DIGITAL
Harmonic Radiation:	Better than –55 dB (160 - 10m amateur bands)
	Better than –65 dB (6m amateur band)
SSB Carrier Suppression:	At least 55 dB below peak output
Undesired Sideband Suppression:	At least 55 dB below peak output
Audio Response (SSB):	Flat Response 10 Hz to 20 kHz, 3-band or 10-band software EQ
3rd Order IMD:	Better than 33 dB below PEP @14.2 MHz 100 watts PEP
Microphone Impedance:	600 Ohms (200 to 10 kOhms)

❖ On Air Operations with the FLEX-3000

Once you have configured the set-up and operations forms, you are ready to put the FLEX-3000 on the air for operation. You will find a basic set-up of the controls for various transmit/receive modes in Chapter Six of the operations manual.

The computer aided tuning (CAT) control commands of PowerSDR are based on those of the Kenwood TS2000 and have been expanded to cover PowerSDR's many unique features. Additionally, PowerSDR can provide a virtual COM port connection to third party software

using a virtual serial port (VSP) driver software package. There are two programs available, depending on your computer platform.

vCOM is a virtual communications port that only works on the Windows XP platform and it is a 32-bit application. A better software choice (and it is free) is K5FR's VSPmanager. This null-modem emulator (VSPmanager) is a 64 and 32-bit signed kernel-mode virtual serial port driver for all Windows packages. You can create an unlimited number of virtual COM port pairs and use any pair to connect one COM port-based application to another. This program, and instructions for installation and use, are available for downloading at **http://k5fr.com/ddutilwiki/index.php?title=VSP_Manager**.

The FLEX-3000 is an excellent unit for digital mode operations, but using a sound card and operating using a FlexRadio Radio SDR is a little different from using a traditional analog transceiver. The radio software directly interacts with the sound card based digital mode program, so the primary concern is how do you get the audio from PowerSDR to the digital mode program that is running on the same computer.

Even though there are a couple of ways to accomplish this, the method that FlexRadio recommends is the one that I used. It involves the purchase and download of a third-party software package – the Virtual Audio Cable or VAC.

VAC creates a point-to-point conduit or audio bridge where audio signals that enter into one end of the "cable" come out the other end. Each end of the "cable" looks like a sound card device in Windows. So, to transfer audio signals from PowerSDR to a digital mode sound card program, we defined two (2) VAC "cables," one for the received audio and one for the transmitted audio. Therefore, all you need to operate digital mode with PowerSDR and any of FlexRadio Systems software defined radios is to obtain a legal copy of VAC.

VAC is a third-party application and is not provided by FlexRadio Systems as a standard component of a software defined radio. This software package must be purchased directly from NTONYX by the user. You can find out more about VAC and how to purchase it from their web site at **http://software.muzychenko.net/eng/vac.html**.

The bottom line is that each third party digital/logging/contest program has its own method of CAT control and selecting the COM port and sound card. You will need to dig in the books for your software and the PowerSDR to put everything in order and operate digital modes with your FLEX-3000. FlexRadio tech support can provide some basic support in this regard, but they can't provide guidance on every software package out there. Patience and a good understanding of your software package will usually get the job done and get you on the air digitally.

You can get detailed information on digital operations with the FLEX-3000 on the FlexRadio Systems website in the Knowledge Center at **http://kc.flex-radio.com/KnowledgebaseCategory58.aspx**.

❖ How did it perform?

The review unit arrived just in time to put it on the air for the ARRL International SSB contest. Even though the FLEX-3000 has a 100 watt continuous duty transmitter, I especially enjoy operating the 3000 as a 5 watts QRP entrant in the contest and I knew that this would be a good test for the FLEX-3000. If it performed well during this busy ham band weekend at the low end of the sunspot cycle, then it would be a welcome addition to any shack under a wide variety of conditions.

In sum, with one exception, I was very impressed with the FLEX-3000 under contest conditions. The ability to implement a wide variety of filter combinations proved invaluable in picking out weaker stations with smaller pileups that allowed me to work them using my 5-watt power requirement. The other plus was the ability to customize my transmit audio to cut through the pileups and get my QRP signal heard.

The final result was 170 stations worked and 108 foreign multipliers counted on 15, 20, 40 and 80 meters. During the pre-contest period, I used my time to experiment with a wide variety of transmit audio combinations with various DXCC stations. Audio and signal reports were excellent in every case and most stations were quite surprised I was running QRP.

The only downside I found with the FLEX-3000 was with the automatic tuner unit (ATU). Quite frankly, it performed erratically all weekend long when coupled with my wire antenna farm. I was consistently getting high SWR readings and messages requiring me to bypass the tuner and use my manual Armstrong MFJ tuner.

Once I realized that there was an issue with the ATU and I switched over to my MFJ antenna tuner, my contest station count rose accordingly.

I am not the only person to note this ATU problem. It has been mentioned by many on the FlexRadio newsgroup. According to company officials they have just finished a complete re-write of the ATU software. It is currently in beta test and will be included in their v2.0 software release that should be available by the time you read this. According to one company source early testing indicates the problem has been solved and the ATU operations are now "amazing."

Bottom line, this is a great radio in receive/transmit capability for the money. FlexRadio Systems is a solid/dependable company and has one of the best tech support teams I have seen in a long time. Dudley Hurry, who heads their tech support, is extremely knowledgeable individual and was a pleasure to work with.

The FlexRadio Systems FLEX-3000 transceiver sells for a MSRP of $1699.00 and is available online at the company website **www.flex-radio.com**.

So, if you like operating on the cutting edge of technology, the FLEX-3000 transceiver is an affordable solution that will let you experience the excitement of six meters and HF radio like no other radio in its price class.

All About Antennas continued from page 17

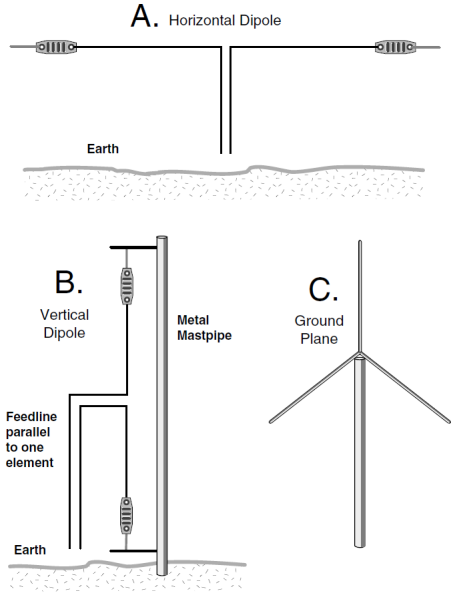
Just because it's a transmatch doesn't mean it's a good transmatch. Flimsy construction and small-gauge wire may mean additional losses, especially at higher power levels. High-power transmatches are invariably more efficient than the low-power variety.

Efficiency

Efficiency is a commonly misunderstood concept in antenna system design; it is simply the percentage of transmitter-generated signal which is radiated by the antenna, or received signal voltage which is delivered to the receiver. If there were no resistive or insulation losses, any antenna and feed line would be 100% efficient whether or not they are properly matched.

Balanced or Unbalanced?

Most elevated, horizontal antennas are fed at or near the center; they are said to be balanced, both from a standpoint of symmetry as well as reference to ground.



Most vertical antennas are unbalanced, often making use of radial systems as an artificial ground reference. There is nothing inherently superior about one over the other; it is merely a question of whether they are best fed by twin lead (balanced) or coax (unbalanced). Balun (balanced-to-unbalanced) transformers, which we will discuss later, as well as transmatches can be used to match balanced to unbalanced circuit elements, and to match impedances.

What is the penalty for misbalancing the feed point? It may cause some RF current to flow on the surface of the feed line, or some stray radiation from the feed point, producing some distortion in the pattern's symmetry, affecting gain somewhat.

Next Month

The last part of this series. Choosing an antenna to match the task. How about accessories? Final take-home points.

What's NEW

Tell them you saw it in Monitoring Times

A New Icom All-Around Rig

Icom has announced that a new all-round amateur radio transceiver, the IC-9100 transceiver, will be released soon. This new amateur radio transceiver will have a VHF/UHF satellite capability including 2-meter/70-cm/1200 MHz bands, an HF/50 MHz rig with a general coverage receiver, and D-Star DV mode capability with an optional module.

The pre-release announced IC-9100 main features and accessories include:

- HF/50-MHz, 144/430 (440) MHz, and 1200-MHz coverage with optional UX-9100.
- 100 Watts on HF/50/144-MHz, 75 Watts on 430 (440) MHz, and 10 Watts on 1200-MHz (UX-9100 required).
- Double superheterodyne receiver with image rejection mixer.
- Satellite mode operation.
- SSB, CW, RTTY, AM, FM and DV (optional D-STAR unit required) modes*
- 32-bit floating point DSP and 24-bit Analog-to-Digital (AD)/Digital to-Analog (DA) converter.
- Optional 3-kHz/6-kHz, 1st IF (roofing) filters (optional FL-431 3-kHz filter and/or FL-430 6-kHz filter required) for HF/50-MHz bands.
- Optional D-STAR DV mode operation with optional D-STAR unit*

* *Some restrictions may be applied in combination with operating frequency and mode.*

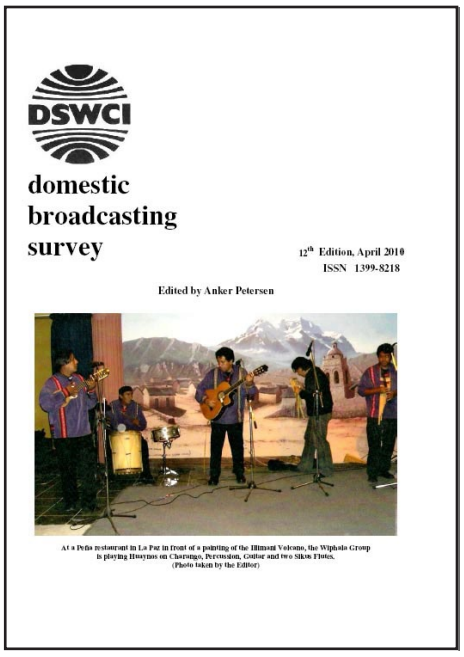
We hope to have more information on this unit, including pricing and availability, as soon as it has been type accepted by the Federal Communication Commission (FCC).

Review of Domestic Broadcast Survey 12th Edition

Danish Shortwave Club International has recently released the 12th annual edition of *Domestic Broadcast Survey*. This new edition is edited by DSWCI Chairman, Anker Petersen, and is divided into three parts.

Part one covers all active broadcasting stations on 2300-5700 kHz, including clandestine stations. Part two includes domestic stations on international shortwave bands above 5700 kHz broadcasting to a domestic audience. Part three has deleted frequencies between 2 and 30 MHz which have not been reported during the past five years, but may return to the airwaves.

Information presented in this edition of



the *DBS* is based upon official sources and radio hobby DX bulletins. Official sources such as the A10 broadcast schedules are included when they are available prior to publication of the *DBS*. Monitor reports from club monitors from around the world during the period May 2009 to March 2010 comprise the monitored observations. Based on these observations, active stations are listed with an A ("regular operations"), B ("irregular operation") or C ("sporadic activity") and D ("likely inactive") stations.

All listings are in an easy to follow format, sorted by frequency, power in kilowatts, country, station and operating schedules. Parallel frequencies and operating format are also given. The right column lists the "Last Log," and shows the last month and year the station was logged before the *DBS* publication deadline.

All buyers of this new edition will receive a username and password to access the monthly updates on the tropical bands published as *Tropical Bands Monitor* on the club's website at **www.dswci.org**

DBS-12 is available by email in a PDF format (about 365 kB). A limited number of copies are available in printed form. Rates for the various formats are:

E-Mail edition: DKK 35,00 or USD 7.00 or EUR 5,00 or GBP 4,00 or SEK 50,00 or IRC 4.

Printed edition: DKK 65,00 or USD 12.00 or EUR 9,00 or GBP 8,00 or SEK 90,00 or IRC 7.

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If you have the Euro as your national currency, you will be paying our representative in Germany – Andreas Schmid. If you want to purchase the DBS-12 via PayPal, contact Andreas Schmid for information on doing a PayPal transfer at Andreas Schmid, Lerchenweg 4, D-97717 Euerdorf, Germany (Account 2912472076 at Citibank BLZ: 30020900. BIC: CIPRDEDD. IBAN: DE24300209002912472076).

To learn more about Danish Shortwave Club International and view a sample DBS-12 page visit their website at **www.dswci.org**.

The *Domestic Broadcasting Survey-12* is one of the best sources for domestic shortwave broadcast information available. It is a must-have in the radio library of any active shortwave broadcast radio hobbyist. *Review by Gayle Van Horn, W4GVH.*

South Carolina Upstate Scanner Guide

Radio research and editor Larry Williams has released a new scanner guide, the *South Carolina 2010 Special Edition Upstate Scanner Frequency Guide*.

This latest edition traces its roots back to the first release in 1981 and subsequent editions have been providing area radio hobbyists with current and accurate information on monitoring VHF/UHF/800 MHz UpState scanner traffic.

Areas covered in this 2010 edition include: Palmetto 800 TRS and county listings for: Abbeville, Anderson, Cherokee, Greenville, Greenwood, Laurens, Newberry, Pickens, Oconee, Spartanburg, and Union counties. There is also coverage of Myrtle Beach and some selected western North Carolina public safety agencies.

Other sections of this 64-page book cover VHF and UHF by-frequency lists with CTCSS codes; aircraft frequencies including military UHF frequencies; marine and ham radio frequencies; and other listings including Internet websites, surveillance frequencies, business-industrial frequencies, area 800 MHz trunking codes and area public safety dispatch codes.

South Carolina Upstate Scanner Guide sells for $9.95 postage paid and can be ordered online by contacting Larry Williams via email at larryscan@charter.net or via snail mail to Radio Research, 10 Elf Lane, Greenville, SC 29617.

Books and equipment for announcement or review should be sent to What's New, c/o Monitoring Times, 7540 Highway 64 West, Brasstown, NC 28902. Press releases may be faxed to 828-837-2216 or emailed to Larry Van Horn, *larryvanhorn@monitoringtimes.com*.

When ordering or inquiring about the products mentioned in this column, be sure to tell them that you saw it in the pages of *Monitoring Times* magazine.

LETTERS

editor@monitoringtimes.com

This column is open to your considered comments. Opinions expressed here are not necessarily those of Monitoring Times. Your letters may be edited or shortened for clarity and length. Please mail to Letters to the Editor, 7540 Hwy 64 West, Brasstown, NC 28902 or email editor@monitoringtimes.com

Happy monitoring!

Rachel Baughn, Editor

Rachel Baughn
rachelbaughn@monitoringtimes.com

New Uses for Old Frequencies

"Bob, I noted something interesting about the 'new' frequencies of WWCR in Nashville. They are very close to the old RCMP-Interpol frequencies of the 1980s. I just happened to notice the new frequency of 4.775 kHz is what was probably the SSB carrier frequency for 47765.5, listed in [*an old*] *MT* clipping and referring to your *Shortwave Frequency Directory*.

"The new FCC Test Freq for WWCR is 4.840 kHz. This is close to 4837.5 kHz listed by Steven J. Handler in *World Radio Communications Guide* in 1979. Handler would have gotten a kick out of his guide still being used 31 years later.

"I am interested in these old frequencies. I suspect some may go back to the 1930s, but there seems to be little information. What I am interested in are the old Canadian CW-AM nets of RCMP, Hudson's Bay Company, Transcanada Air Lines, and other Air Lines, Interpol. I am also interested in the SSB nets post WWII.

"In the U.S., I find very little info on callsigns of the Civilian Conservation Corps. In a list I am compiling of the CCC camps, I find no callsigns for New York, New England and Texas. Any ideas?

"In the event I get a website up on ancient communication , could I have permission to copy the RCMP-Interpol frequency, callsign, location info from your *Shortwave Frequency Directory* with proper credit to you?"

Don LeFevre KD5RCG

Absolutely; I'd be delighted to know that the old *Shortwave Frequency Directory* is still useful! Just give the attribution to be safe.

Good luck in your frequency search.

Bob Grove

Rhombic True and False

"In the November *Monitoring Times* under *Letters* there are comments about the Navy AN/FRD-10 antenna. Most of the information is accurate, but it is referred to as a 'rhombic direction-finding antenna.'

"A rhombic antenna is a fantastic, highly directional, but absolutely fixed antenna. Once the poles are planted to support the wire it does not move.

"On a related subject, the Maritime Radio Historical Society is looking for funding to restore the remaining rhombic antenna at the KPH Receiving Station ('RS') in Point Reyes, California. At one time RCA had many of those antennas, and one remains, although some of the wires are on the ground."

Bill Ruck, Maintenance, Maritime Radio Historical Society

I see various references to the AN/FRD-10 as 'Classic Bullseye,' Wullenweber Array,' 'Circularly Disposed Dipole Array (CDDA),' 'Circularly Disposed Antenna Array (CDAA),' 'Elephant Cage,' 'Turkey Cage,' and 'Dinosaur Cage!'

According to web references, it is theoretically a switchable array of folded monopoles made directional by a rear screen. But it certainly isn't a rhombic.

I've often wondered why they didn't just use an Adcock Array!

Bob Grove W8JHD

Airwaves are Public!

"After reading your article in the *Communications* column ('Say Good-Bye to OTA-TV' *MT* Feb., 2010), I for one was really upset to think that the FCC thinks that they are the sole owners of the air space in the United States. I think that the citizens of this country are the owners...I hope your article will wake some of these people up. Why do they think that they can just keep on selling air space off as they please? OTA-TV is not anywhere near dead. Million and millions of people bought the digital converter boxes and use them on one or more TVs in their homes. Not everyone can afford to have cable-TV...The taxpayers of this country should not have to pay for any more new TV systems."

Joseph Connelly, North Bergen, NJ

While the FCC does not claim to own U.S. airwaves, it does claim to represent the interests of the people in attempting to decide spectrum issues. But, thanks to an over-friendly relationship with business interests, the result of a lucrative "revolving door" policy that allows FCC commissioners to move seamlessly between adjudicating the interest of the people and working for industry, the real interests of the people appear to be shortchanged. Interestingly, this cozy relationship thrives regardless of which party is in power.

Without any groundswell of rebuke by the people, the FCC and commercial interests will continue to push for changes that will not sit well with many of us. Your recourse is to write your congressional representatives and urge them to protect OTA broadcasting.

The FCC allows comment from individuals on various issues that are before it. However, this is usually done during an official "comment" period, of which most individuals are unaware, but which are widely known among industry lobbyists. For more information about FCC policies got to www.fcc.gov or call toll free at 888-225-5322 or FAX toll free at 866-481-0232.

Ken Reitz

Flying High

Rick NQ4I forwarded the following email regarding his *First Person Radio* article "CQ at 51,000 feet and 565 MPH" (*MT* March, 2010):

"Rick, I just wanted to let you know that I really enjoyed your article in this month's *Monitoring Times*. It's great the way you have been able to combine your two favorite hobbies into a career and serious contesting. Your HF contesting station is phenomenal. I have had the pleasure of going on my company's G-V and it is a beautiful aircraft. Keep up the great work and thanks for the terrific article."

Don Young N2DY

Another Source for New Old-Time Radio

"Fred, as a subscriber to *Monitoring Times*, I enjoy reading your 'Programming Spotlight' column each month.

"Your February 2010 column about the 'Golden Age of Radio' provoked me to let you know about a small outfit that creates new old-time radio productions. They are called the Atlanta Radio Theater Company, or ARTC. Most of their work is in the fields of science fiction, mystery, and horror, but they do a few other things as well.

"For years they have performed live in theaters and at special-interest conventions. They now have a broadcasting outlet on an Atlanta-area radio station. They also distribute podcasts and sell CDs. … Their website is **www.artc.org**.

"I have attended a number of their performances. Even though they are an all-volunteer group, their work is of high quality and worthy of wider notice."

Mike Rogers, Hixson, TN

Thank you for the heads up about the Atlanta Radio Theater Company. It's something I will certainly look into! I'm a big fan of old time radio and those that keep it alive. Sounds like an interesting group.

There is also a program on BBC Radio 7, which reconstructs old Marx Brothers radio scripts. It makes me wonder if they are done by the same group or another similar group, and just how many such groups exist. A future column for sure!

Thanks for the feedback; it's very much appreciated.

Fred Waterer

Longwave Kudos

"Hey Kevin, Thanks for your interesting article about longwave websites to bookmark in the April issue. I`ve just gotten interested in the basement band and have logged several stations already. Your article was a real help for me in finding places to look things up and people that share my interest in the basement band! I like your articles and loggings. Real neat stuff."

Robbie Spain, Wyoming

Robert Thomas

MT Frequency Manager Gayle Van Horn says, "One of my long-time frequency contributors passed away March 30. For over ten years, Robert Thomas of Bridgeport, CT kept me up to date from his monitoring the new seasonal changes. Like clock work, Bob was always there, and I will miss his friendship and correspondence."

We extend our condolences to Robert's family and friends.

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Columnist Blogs and Web Sites

These blogs and web pages were created by some of our columnists to better serve their readers. While we highly recommend these resources, they are not official instruments of Monitoring Times.

AMERICAN BANDSCAN
http://americanbandscan.blogspot.com/ - by Doug Smith

FED FILES
http://mt-fedfiles.blogspot.com/ - by Chris Parris

MILCOM
http://mt-milcom.blogspot.com/ - by Larry Van Horn

LARRY'S MONITORING POST
http://monitor-post.blogspot.com/ - by Larry Van Horn

SCANNING REPORT
http://www.signalharbor.com/ - by Dan Veeneman

SHORTWAVE
http://mt-shortwave.blogspot.com/- by Gayle Van Horn

UTILITY WORLD
http://mt-utility.blogspot.com/- by Hugh Stegman
www.ominous-valve.com/uteworld.html

Looking for Writers

MT is soliciting feature articles, reviews, and how-to articles covering shortwave broadcasting, utilities, scanning, frequency profiles, construction projects or whatever excites you! Contact Feature Editor Ken Reitz at *kenreitz@monitoringtimes.com* or write c/o Monitoring Times, 7540 Hwy 64 West, Brasstown, NC 28902.

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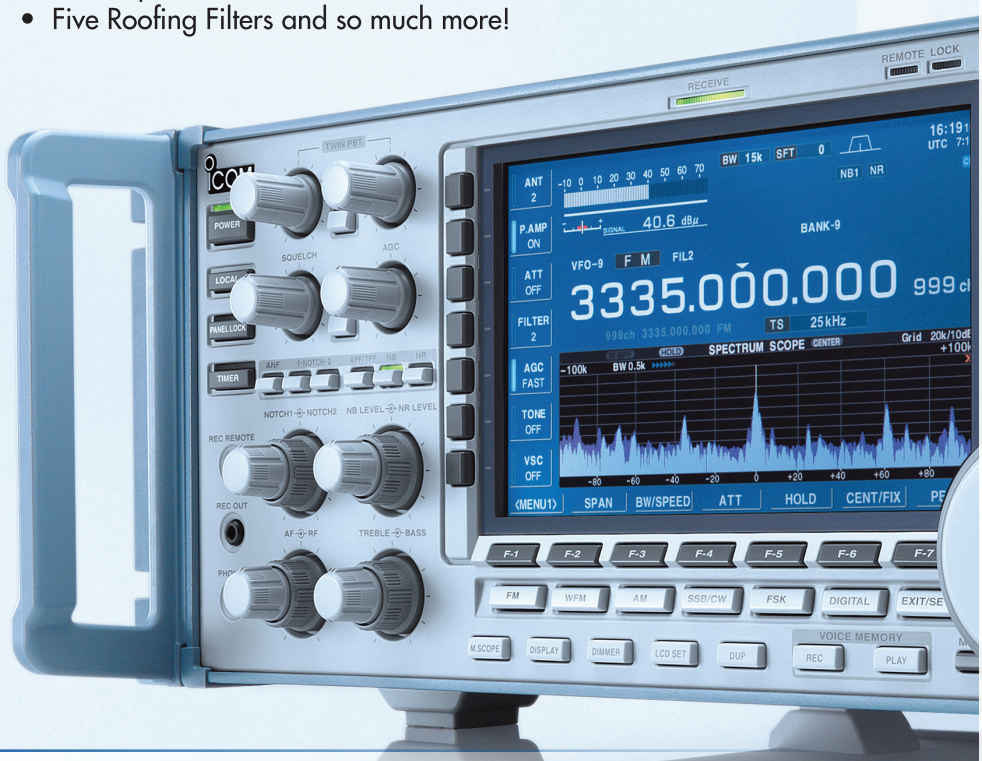

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